Scientific Excellence • Resource Protection & Conservation • Benefits for Canadians
Excellence scientifique • Protection et conservation des ressources • Bénéfices aux Canadiens

An Atlas of the Annual and Seasonal Distribution of Marine Fish and Invertebrates in St. Georges Bay, Nova Scotia (1985 to 1988)

H. P. Benoît, E. Darbyson, T. Hurlbut and D. Clay

Fisheries and Oceans Canada
Gulf Fisheries Centre
P.O. Box 5030
Moncton, N.B.
E1C 9B6

2003

Canadian Data Report of Fisheries and Aquatic Sciences 1114

Fisheries and Oceans Pêches et Océans

Canada

Canadian Data Report of Fisheries and Aquatic Sciences

Data reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of data reports reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Data reports are not intended for general distribution and the contents must not be referred to in other publications without prior written authorization from the issuing establishment. The correct citation appears above the abstract of each report. Data reports are abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1–25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26–160 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Data Reports. The current series name was introduced with the publication of report number 161.

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport statistique canadien des sciences halieutiques et aquatiques

Les rapports statistiques servent à classer et à archiver les compilations de données pour lesquelles il y a peu ou point d'analyse. Ces compilations auront d'ordinaire été préparées à l'appui d'autres publications ou rapports. Les sujets des rapports statistiques reflètent la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports statistiques ne sont pas destinés à une vaste distribution et leur contenu ne doit pas être mentionné dans une publication sans autorisation écrite préalable de l'établissement auteur. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports statistiques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 25 de cette série ont été publiés à titre de relevés statistiques, Services des pêches et de la mer. Les numéros 26 à 160 ont été publiés à titre de rapports statistiques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 161.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Data Report of Fisheries

and Aquatic Sciences No. 1114

2003

AN ATLAS OF THE ANNUAL AND SEASONAL DISTRIBUTIONS OF MARINE FISH AND INVERTEBRATES IN ST. GEORGES BAY, NOVA SCOTIA (1985 TO 1988).

by

Hugues P. Benoît, Emily Darbyson, Tom Hurlbut and Doug Clay

Fisheries and Oceans Canada

Gulf Fisheries Centre

P.O. Box 5030, Moncton, N.B.

E1C 9B6

© Minister of Public Works and Government Services Canada

Cat. No. Fs -97 –13/1114E ISSN 0706-6465

Correct citation for this publication:

Benoît, H.P., E. Darbyson, T. Hurlbut and D. Clay. 2003. An atlas of the annual and seasonal distributions of marine fish and invertebrates in St. Georges Bay, Nova Scotia (1985 to 1988). Can. Data Rep. Fish. Aquat. Sci. no. 1114: iii + 55 p.

103-03942/

Benoît, H.P., E. Darbyson, T. Hurlbut and D. Clay. 2003. An atlas of the annual and seasonal distributions of marine fish and invertebrates in St. Georges Bay, Nova Scotia (1985 to 1988). Can. Data Rep. Fish. Aquat. Sci. no. 1114: iii + 55 p.

ABSTRACT

Annual bottom-trawl surveys were conducted in St. Georges Bay (Nova Scotia) in early June to late October from 1985 to 1988, to determine the feasibility of using limited nearshore abundance surveys as a supplement to the annual September bottom-trawl survey in the southern Gulf of St. Lawrence, conducted since 1971. This atlas provides a collection of seasonal and inter-annual geographic distribution maps for some of the marine fish and invertebrates caught during the St. Georges Bay surveys.

RÉSUMÉ

Des relevés annuels au chalut de fond furent effectués dans la Baie St.-Georges (Nouvelle Écosse) du début juin à la fin octobre en 1985 à 1988, afin de déterminer la possibilité d'utiliser des relevés côtiers pour complémenter le relevé annuel au chalut de fond du sud du Golfe du Saint-Laurent, effectué en septembre depuis 1971. Cet atlas contient une série de cartes de la répartition géographique saisonnière et inter-annuelle de quelque uns des poissons et invertébrés marins capturés lors des relevés dans la Baie St.-Georges.

INTRODUCTION

Bottom-trawl surveys have been conducted annually in the southern Gulf of St. Lawrence during the month of September since 1971 (Benoît et al. 2003; Hurlbut and Clay 1990). These surveys provide information on the abundance and distribution of fish and invertebrate taxa for the late summer and early fall period. This period is believed to be representative of the summer distribution of these organisms, many of which migrate out of the southern Gulf during the late fall and winter months (Darbyson and Benoît, 2003). Prior to 1984, the September surveys did not adequately sample inshore areas, which are significant habitats for some commercially important species such as white hake (*Urophycis tenuis*) and winter flounder (*Pseudopleuronectes americanus*). In 1984, three inshore strata (401-403, see Fig. 1) were permanently added to the survey (Hurlbut and Clay 1990). In addition, a series of bottom-trawl surveys conducted in St. Georges Bay (southeastern Gulf of St. Lawrence), from 1985 to 1988, were intended to determine the feasibility of using limited nearshore abundance surveys as a supplement to the annual September survey. These surveys were conducted throughout the ice-free period, from early June to late October, to describe changes in the seasonal distribution and abundance of demersal species. Given that these surveys covered the period spanning the late spring to the late fall, we refer to them as seasonal surveys hereafter.

The purpose of the present atlas is to provide a brief summary of the St. Georges Bay surveys, along with a compendium of maps showing the seasonal and inter-annual geographic distribution of the organisms captured. Separate maps for catches in numbers·tow^{-1} and kilograms·tow^{-1} are presented for the finfish species, allowing the reader to infer general patterns in size-dependent distribution. Maps for invertebrate taxa

are in kg·tow^{-1} only. It should be noted, however, that the interpretation of patterns in the abundance and distribution of all organisms presented here requires more in-depth analysis and is beyond the scope of this report. For further information on the annual (1971-2002) and seasonal distribution of marine macrofauna for the entire southern Gulf of St. Lawrence, based on bottom-trawl surveys, we refer the reader to Benoît et al. (2003) and Darbyson and Benoît (2003).

BACKGROUND AND METHODS

St. Georges Bay is approximately 30 km in both length and width, and opens along its northern boundary to the Northumberland Strait (Fig. 1). With the exception of a few small "banks", the bay is relatively shallow and homogeneous with respect to depth, with a maximum of only 45 m. Sediment type is also reasonably homogeneous throughout. This area was chosen for the nearshore "pilot" surveys because it is an extensively studied ecosystem, and it has supported demersal and pelagic fisheries for over a century (St. Georges Bay Ecosystem Project, 2002).

The surveys conducted in St. Georges Bay from 1985-1988 followed a fixed station design. Stations included the nine randomly chosen stations used by Kenchington (1980), who had previously conducted extensive bottom trawl sampling in the bay, plus four additional stations (Fig. 2). The latter were selected based on sediment type and geometrical spacing from the other stations in order complete the coverage of the various habitats in the bay. The study area comprised two of the September survey strata, namely 403 and the southern portion of stratum 433 (Fig. 1).

The surveys in St. Georges Bay were conducted by the *CCGS Navicula*, a 20 m long stern trawler, using a 50 foot Flounder Trawl with a wing spread of 8.5 m (details on the gear are provided in Hurlbut and Clay, 1990). Rough bottom sites were not sampled, since the net lacked rollers or other fittings that aid in fishing in such areas. Fishing occurred during daylight hours (06:00-19:00), with a target fishing procedure of a 30 minute tow at 2.5 knots. All catches presented here were therefore standardized to a 1.25 nautical mile tow. Following the protocol for the annual September surveys (see Hurlbut and Clay, 1990), the catch from each tow was sorted by species for all the finfish, lobster and crabs, and to the lowest taxonomic level possible for the other invertebrates.

The stations in St. Georges Bay were first sampled in early June and sampling ended as late as the last week of October. The intention was to sample all 13 stations at least once per month, however due to weather and vessel scheduling this was not always feasible. The plots presented in this atlas are based on combinations of stations sampled each year, grouped into approximate time periods covering 2 to 4 weeks (Table 1). These groupings were made in order to facilitate inter-annual comparisons of patterns in the distribution seasonal (late spring to late fall) of marine macrofauna. Sets of geographic distribution maps, including all time periods and years identified in Table 1, were created for the 28 most common taxa captured in the surveys, using the ACON software package (ACON Win95 8.37, Fisheries and Oceans Canada). The plots are based on expanding circles representing the 10, 25, 50, 75 and 90th percentiles of non-zero catches, with null catches indicated by a plus (+) sign. Separate maps for catches in numbers·tow^{-1} and kilograms·tow^{-1} are presented for the finfish species, while those for invertebrate taxa are in kg·tow^{-1} only. These maps are indexed in Table 2.

CONSIDERATIONS

The maps presented in this atlas reflect the annual and seasonal distribution of marine fish and invertebrates in St. Georges Bay as sampled by the bottom trawl. Because the fishing efficiency of the gear can vary enormously among taxa and with organism body size (Harley and Myers, 2001), abundances should be considered as relative. Also, many gaps in the data exist due to vessel scheduling and postponements due to bad weather. Finally, given the limited geographical coverage of the maps presented in this atlas, the reader should refer to Benoit et al. (2003) and Darbyson and Benoit (2003) for a more complete picture of the annual and seasonal geographic distribution of organisms in the entire southern Gulf of St. Lawrence.

ACKNOWLEDGEMENT

We wish to thank the captain and crew of the *CCGS Navicula* as well as all those who participated in the St. Georges Bay surveys. We also thank Marie-Josée Abgrall for her help with the mapping.

LITERATURE CITED

Benoit, H.P., E. Darbyson and D.P. Swain. 2003. An atlas of the geographic distribution of marine fish and invertebrates in the southern Gulf of St. Lawrence based on annual bottom trawl surveys (1971-2002). Can. Data Rep. Fish. Aqua. Sci. 1112: 185 p.

Darbyson, E., and H. P. Benoit. 2003. An atlas of the seasonal distribution of marine fish and invertebrates in the southern Gulf of St. Lawrence. Can. Data Rep. Fish. Aqua. Sci.1113: 294 p.

Harley, S.J., and R.A. Myers. 2001. Hierarchical Bayesian models of length-specific catchability of research *trawl* survey. Can. J. Fish. Aquat. Sci. 58: 1569-1584.

Hurlbut, T., and D. Clay. 1990. Protocols for research vessel cruises within the Gulf Region (demersal fish) (1970-1987). Can. Manuscr. Rep. Fish. Aquat. Sci. 2082: 143 p.

Kenchington, T.J. 1980. The fishes of St. Georges Bay, Nova Scotia. Can. Tech. Rep. Fish. Aqua. Sci. 955, 154 p.

St. Georges Bay Ecosystem Project. 2000. http://www.stfx.ca/research/gbayesp/

Table 1. Timing and location of seasonal surveys conducted in St. Georges Bay from 1985 to 1988. Stations sampled were grouped roughly by time period. All stations sampled in a given year were considered part of the same "annual" survey. The annual surveys from 1985 to 1988 were N012, N014, N017 and N028, respectively.

Time period	Year	Sites Sampled
June 3-22	1985	3, 6, 7, 8, 9, 10, 11
(June)	1986	1, 4, 5, 6, 7, 8, 9, 10, 12
	1987	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	1988	No sampling
July 2-12	1985	2, 4, 5, 6, 7, 8, 9, 10, 11, 12
(early July)	1986	4, 5, 7, 10, 12
	1987	No sampling
	1988	No sampling
July 17- Aug 6	1985	1, 2, 4, 5, 6, 7, 8, 10, 12
(end of July)	1986	6, 7, 8, 9, 10, 11, 12, 13
	1987	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	1988	No sampling
Aug. 14-16	1985	No sampling
(August)	1986	1, 5, 6, 8, 9, 10, 12, 13
	1987	No sampling
	1988	No sampling
Sep. 9-23	1985	No sampling
(September)	1986	2, 5, 6, 7, 9, 12, 13
	1987	3, 4, 5, 9, 10, 11, 13
	1988	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Oct. 27-29	1985	No sampling
(October)	1986	No sampling
	1987	1, 3, 4, 5, 6, 8, 9, 11, 13
	1988	No sampling

Table 2. Index of species distribution maps for the St. Georges Bay surveys in kg·tow^{-1} (Fig. a) and numbers·tow^{-1} (Fig. b) for finfish and in kg·tow^{-1} only for invertebrates.

Order	Scientific Name	Common Name	Figure #
Clupeiformes	*Clupea harengus*	Atlantic Herring	3 a, b
Gadiformes	*Gadus morhua*	Atlantic Cod	4 a, b
	Merluccius bilinearis	Silver Hake	5 a, b
	Urophycis tenuis	White Hake	6 a, b
Perciformes	*Tautogolabrus adspersus*	Cunner	7 a, b
	Lumpenus lampretaeformis	Snakeblenny	8 a, b
	Zoarces americanus	Common Ocean Pout	9 a, b
Pleuronectiformes	*Glyptocephalus cynoglossus*	Witch Flounder	10 a, b
	Hippoglossoides platessoides	American Plaice	11 a, b
	Limanda ferruginea	Yellowtail Flounder	12 a, b
	Pseudopleuronectes americanus	Winter Flounder	13 a, b
	Scophthalmus aquosus	Windowpane	14 a, b
Rajiformes	*Amblyraja ocellata*	Thorny Skate	15 a, b
	Leucoraja radiata	Winter Skate	16 a, b
Osmeriformes	*Mallotus villosus*	Capelin	17 a, b
	Osmerus mordax mordax	Rainbow Smelt	18 a, b
Scorpaeniformes	*Hemitripterus americanus*	Sea Raven	19 a, b
	Myoxocephalus octodecemspinosus	Longhorn Sculpin	20 a, b

Class	Taxon	Common Name	Figure #
Crustacea	Pandalidae	Pandalid Shrimp	21
	Crangonidae	Snapping Shrimp	22
	Cancer irroratus	Atlantic Rock Crab	23
	Hyas sp.	Toad Crabs	24
	Homarus americanus	Lobster	25
Gastropoda	Gastropoda	Snails and Slugs	26
	Buccinum sp.	Whelks	27
Stelleroidea	Asteroidea	Starfish	28
	Ctenodiscus crispatus	Mud Star	29
	Ophiuroidae	Brittle Stars	30

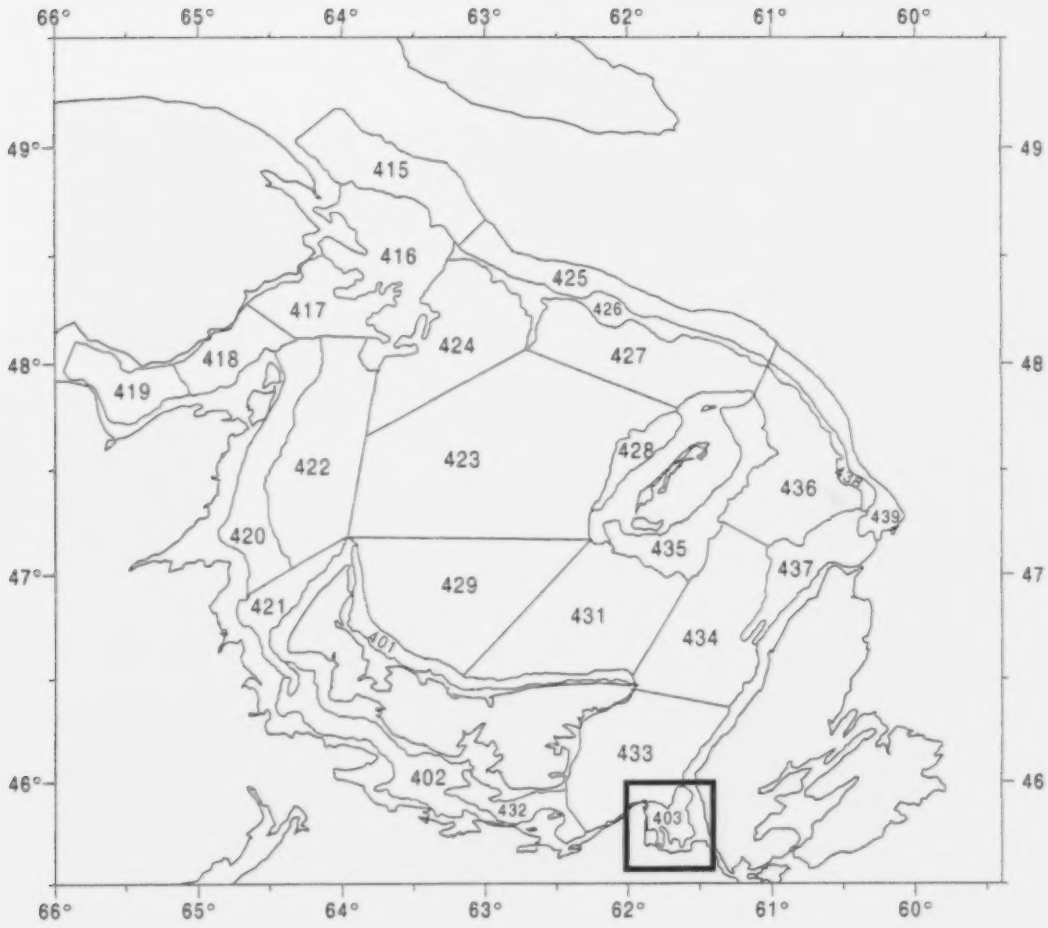

Figure 1. Stratum boundaries for the annual September bottom-trawl survey of the southern Gulf of St. Lawrence (1971-2002).

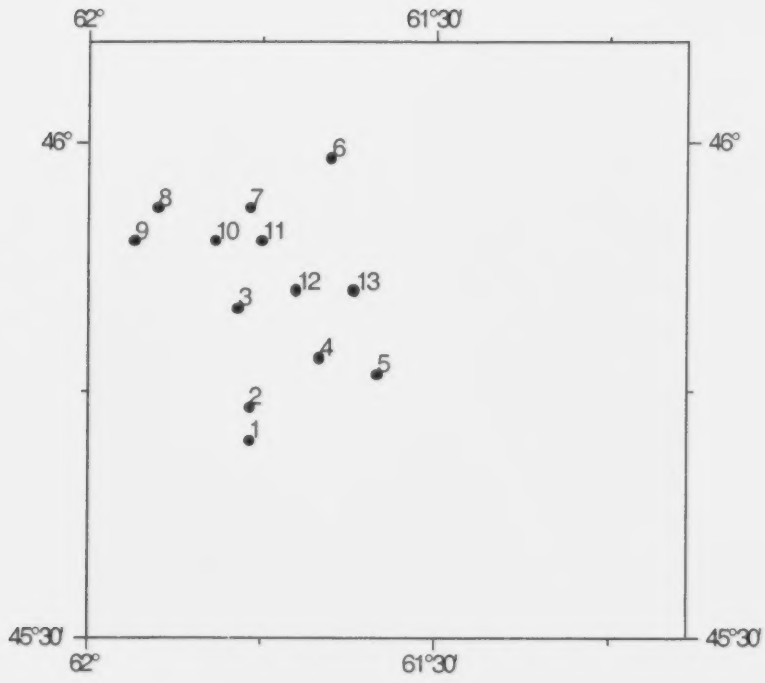

Figure 2. Stations sampled during the St. George's Bay bottom-trawl surveys, 1985-1988.

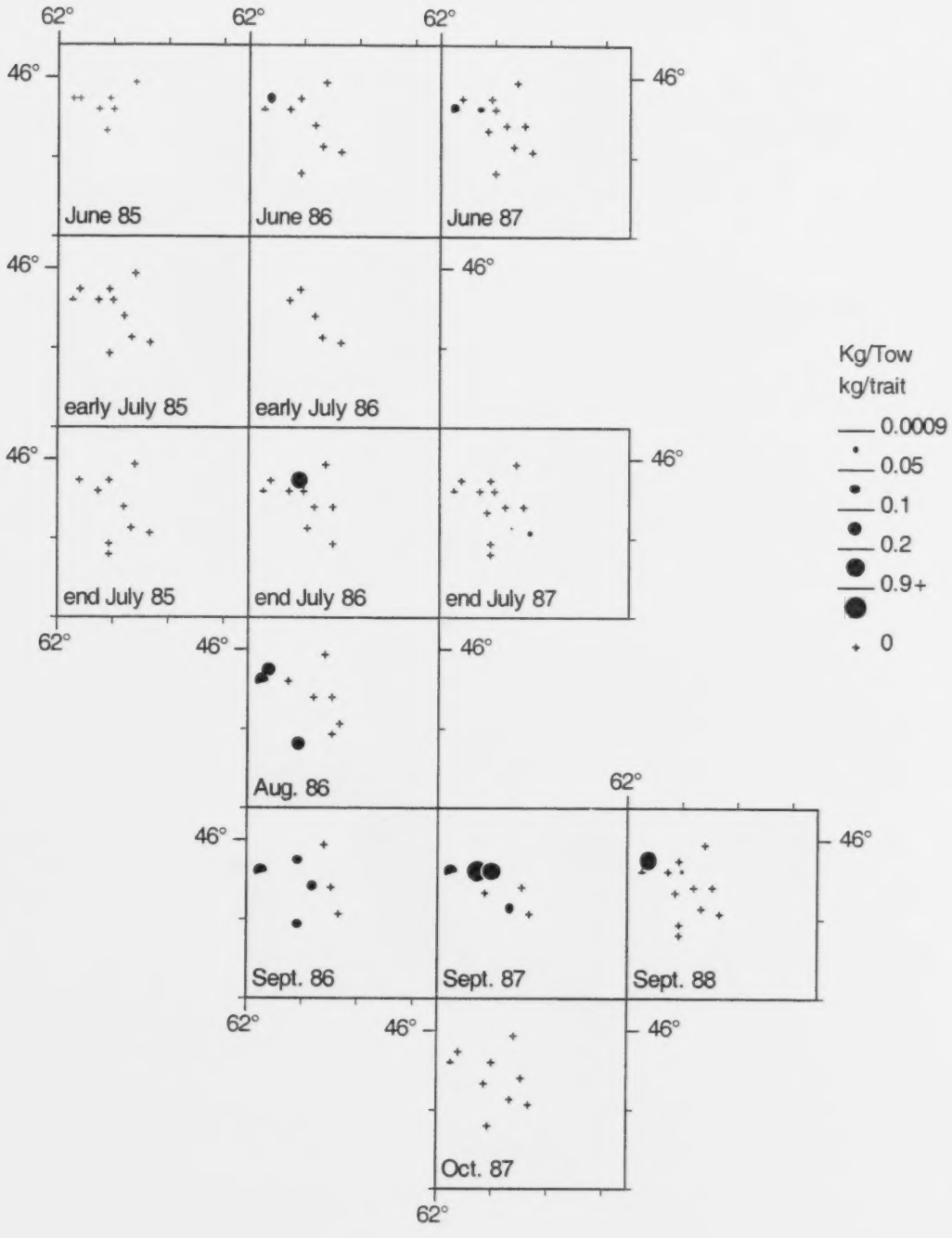

Figure 3a. St. George's Bay seasonal distribution of catches (kg/tow) of Atlantic Herring, *Clupea harengus*.

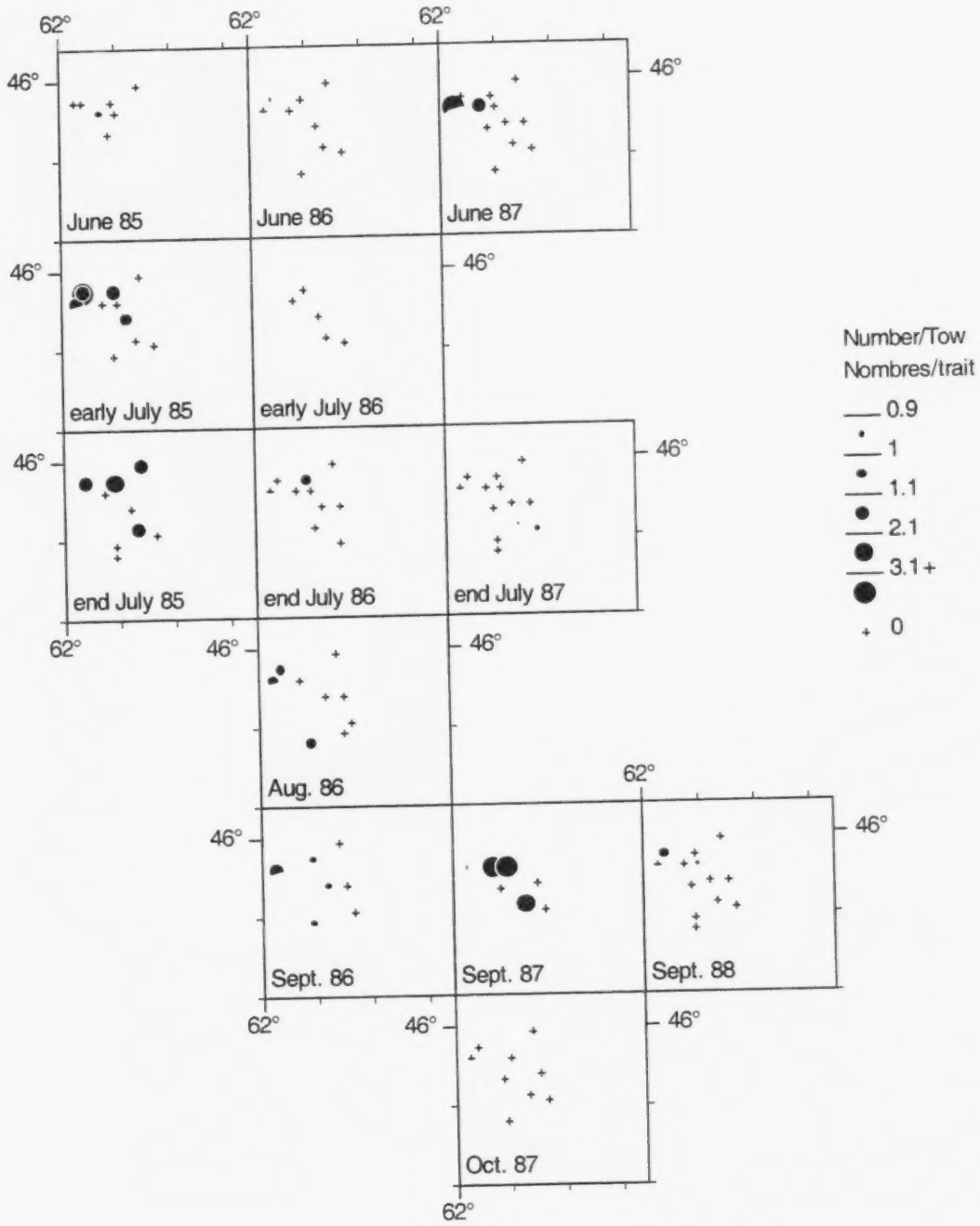

Figure 3b. St. George's Bay seasonal distribution of catches (number/tow) of Atlantic Herring, *Clupea harengus*.

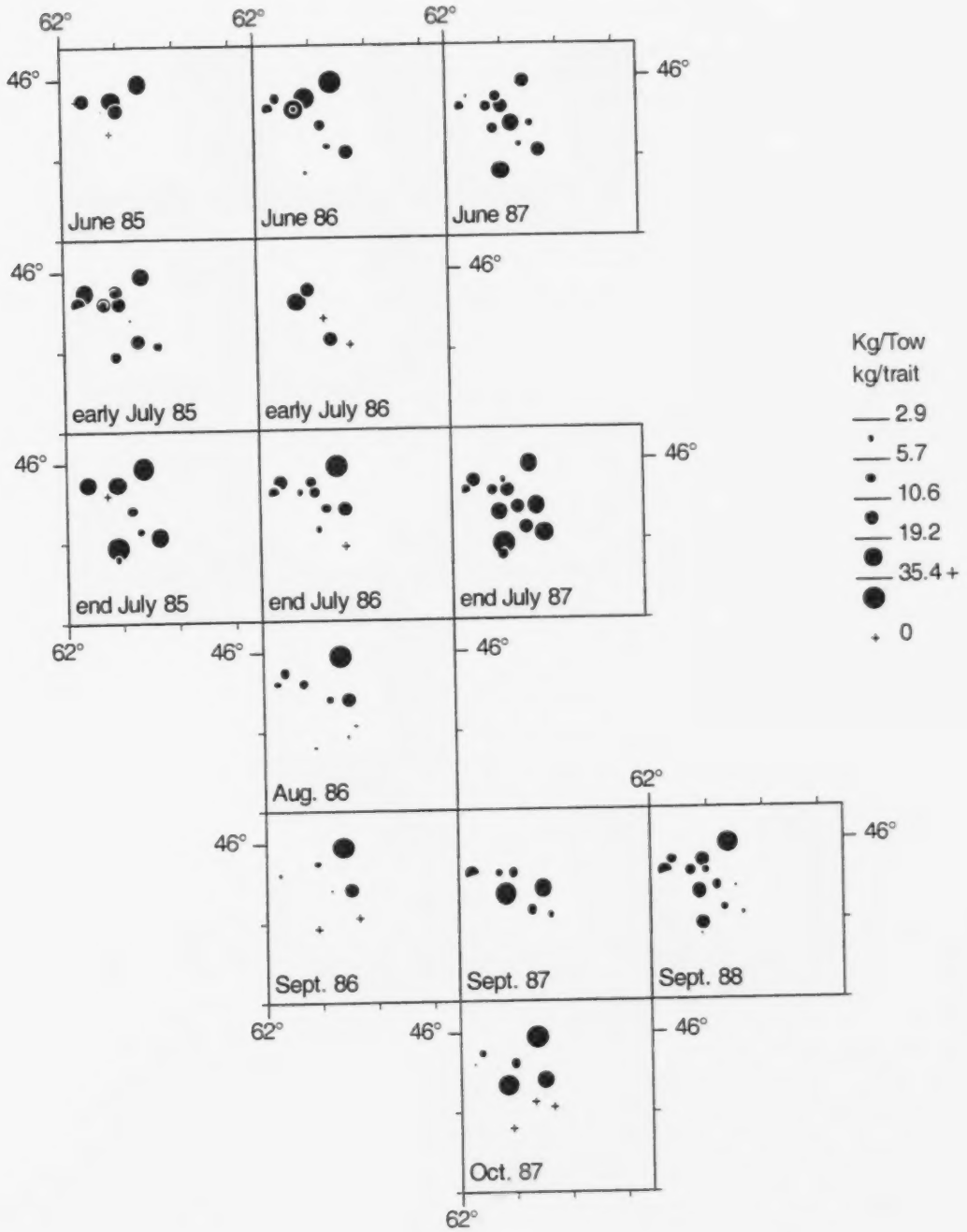

Figure 4a. St. George's Bay seasonal distribution of catches (kg/tow) of Atlantic Cod, *Gadus morhua*.

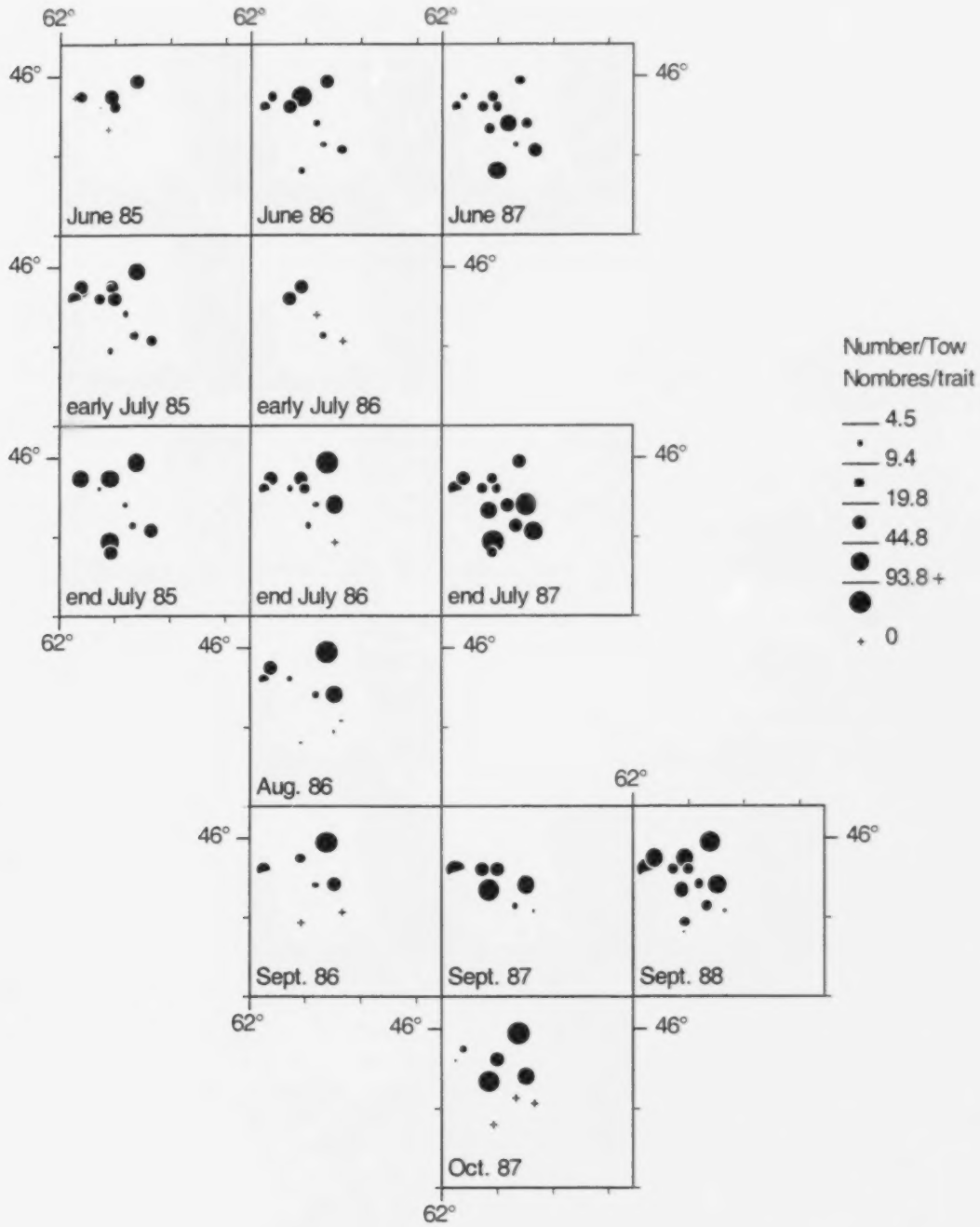

Figure 4b. St. George's Bay seasonal distribution of catches (number/tow) of Atlantic Cod, *Gadus morhua.*

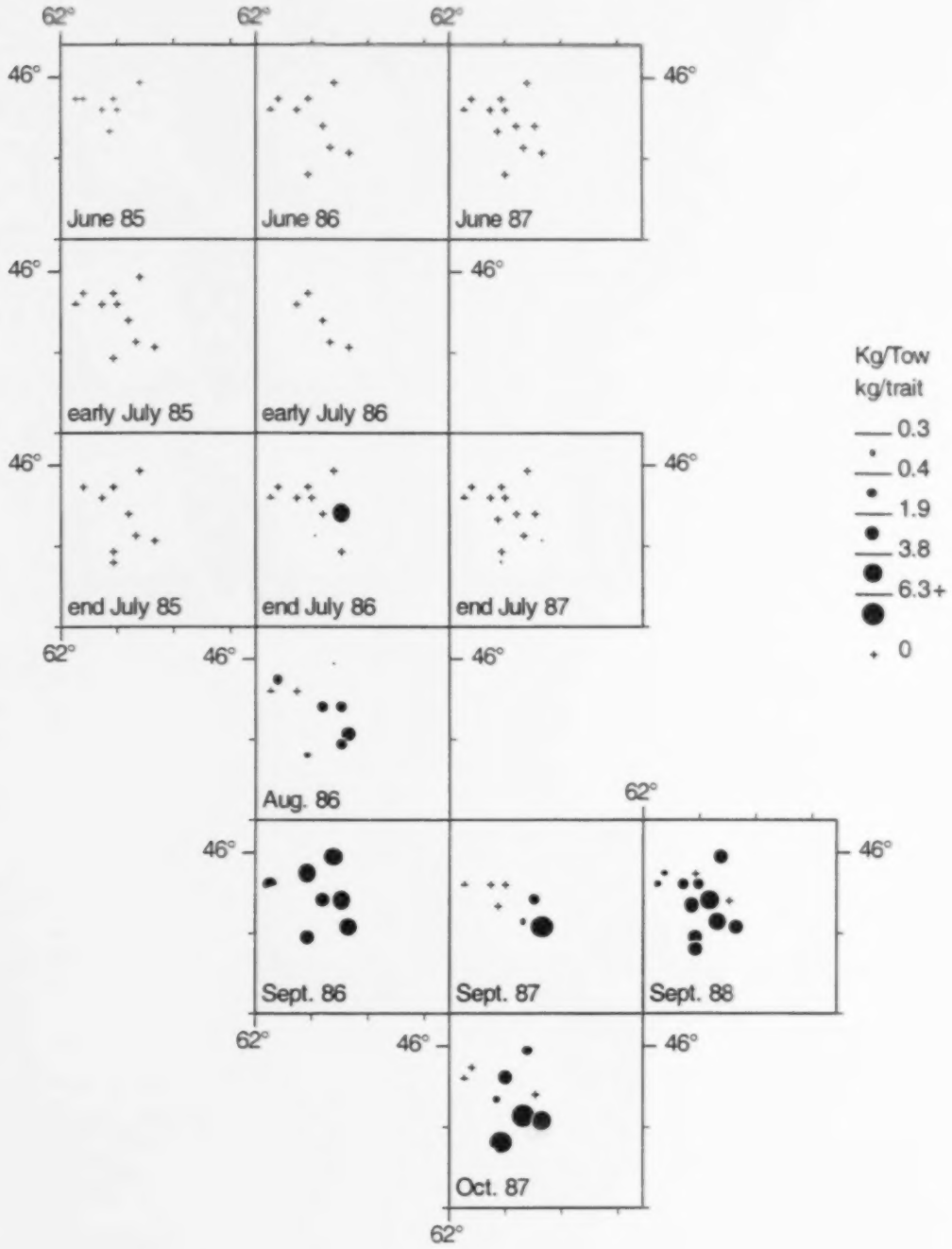

Figure 5a. St. George's Bay seasonal distribution of catches (kg/tow) of Silver Hake, *Merluccius bilinearis*.

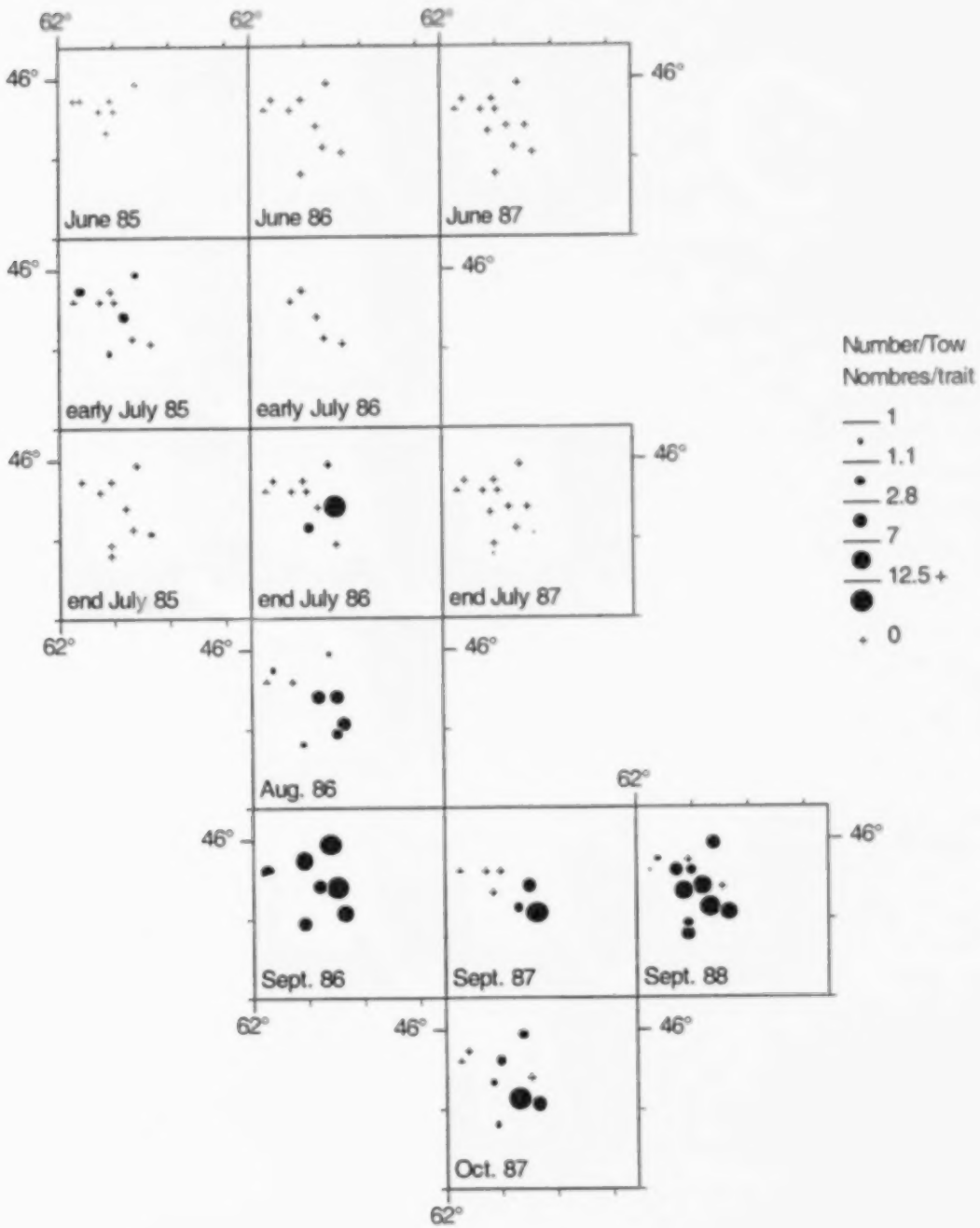

Figure 5b. St. George's Bay seasonal distribution of catches (number/tow) of Silver Hake, *Merluccius bilinearis*.

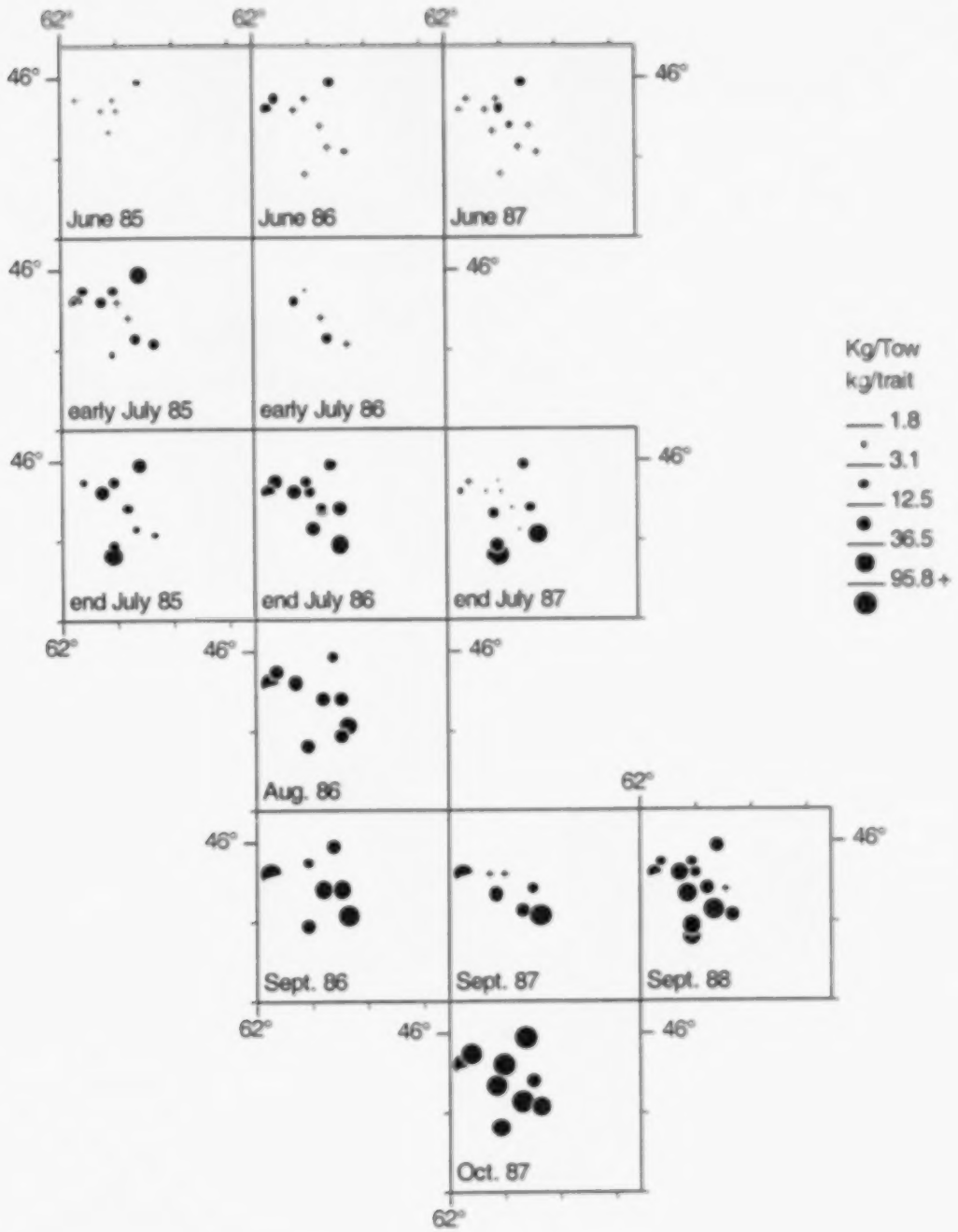

Figure 6a. St. George's Bay seasonal distribution of catches (kg/tow) of White Hake, *Urophycis tenuis*.

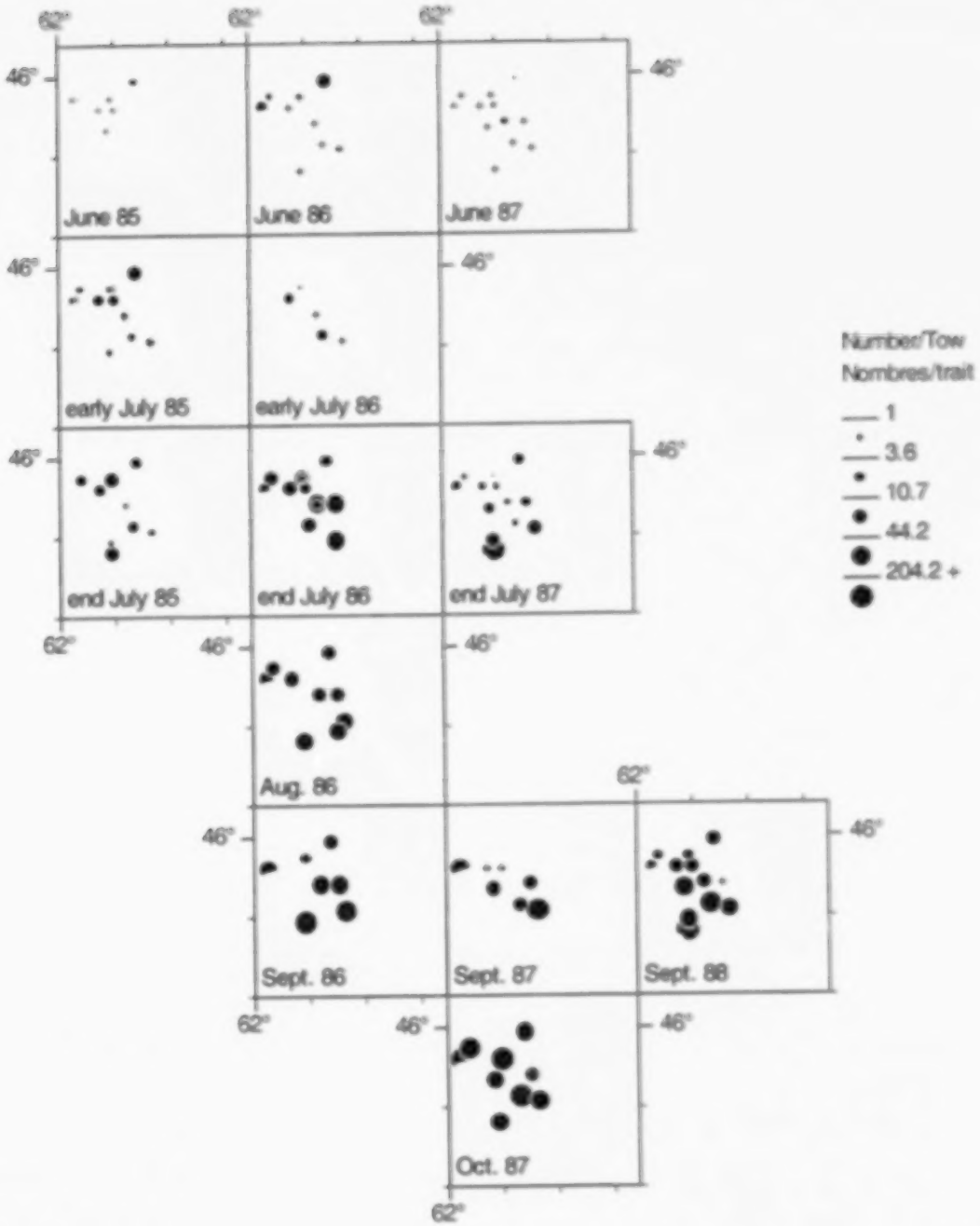

Figure 6b. St. George's Bay seasonal distribution of catches (number/tow) of White Hake, *Urophycis tenuis*.

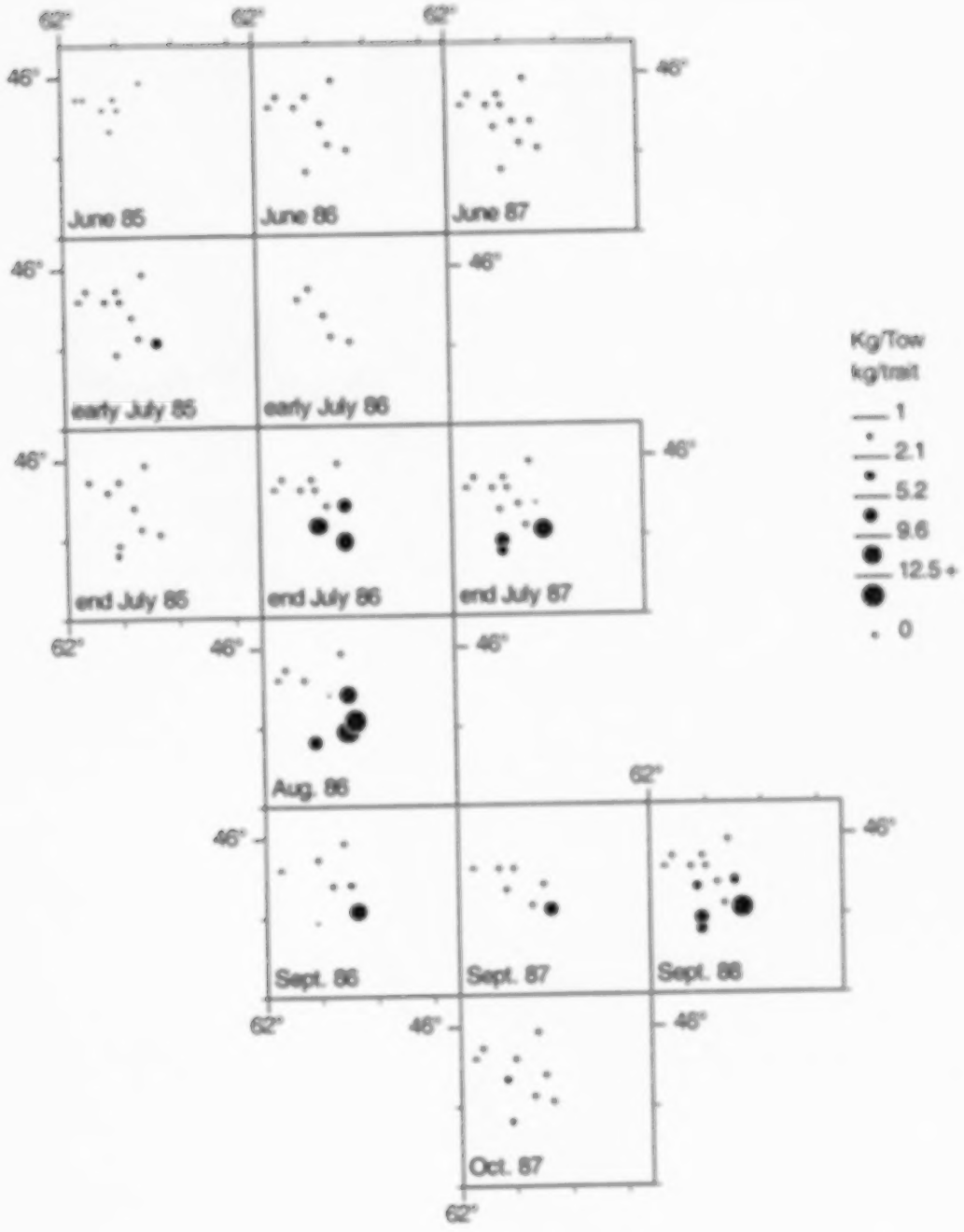

Figure 7a. St. George's Bay seasonal distribution of catches (kg/tow) of Cunner, *Tautogolabrus adspersus*.

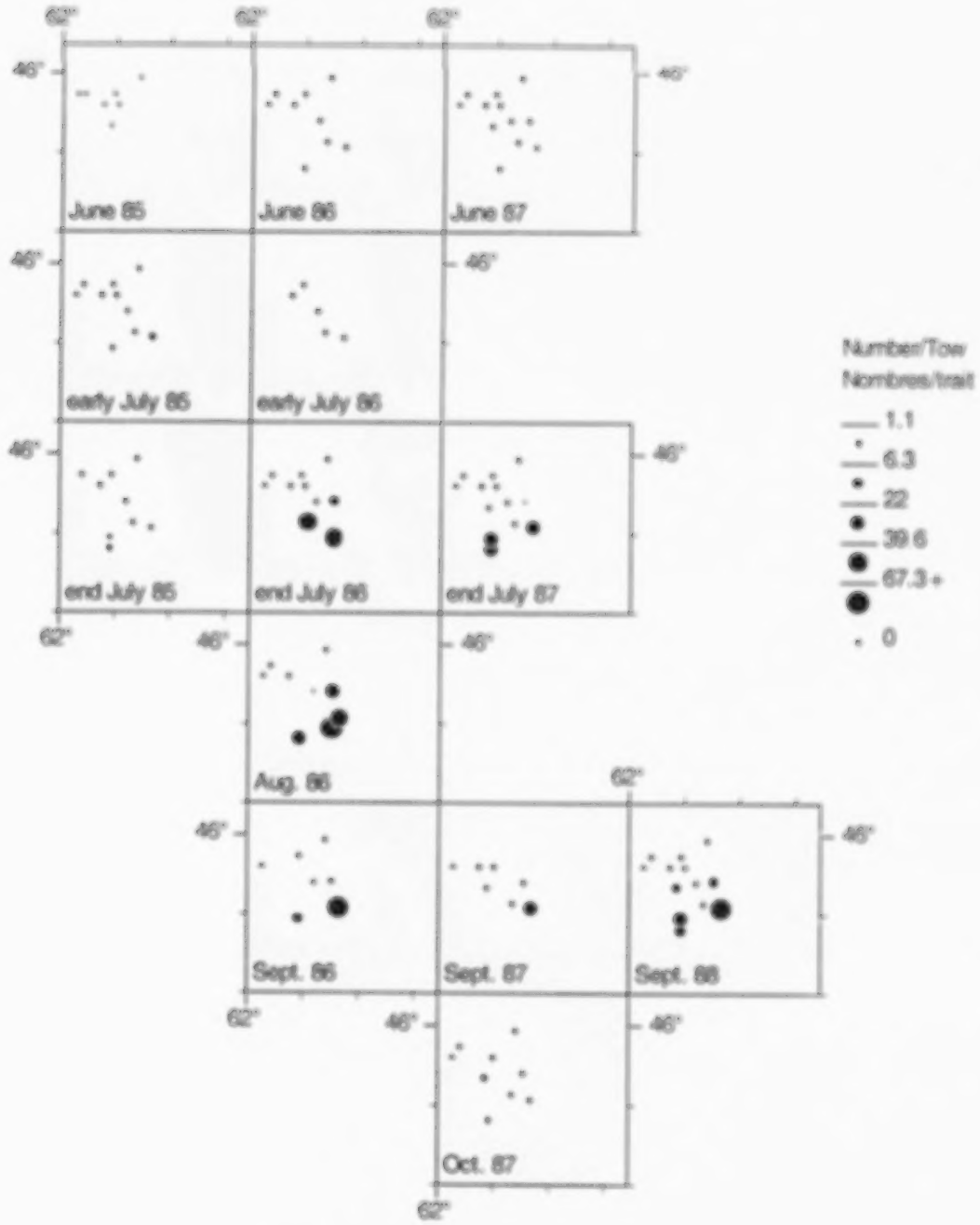

Figure 7b. St. George's Bay seasonal distribution of catches (number/tow) of Cunner, *Tautogolabrus adspersus*.

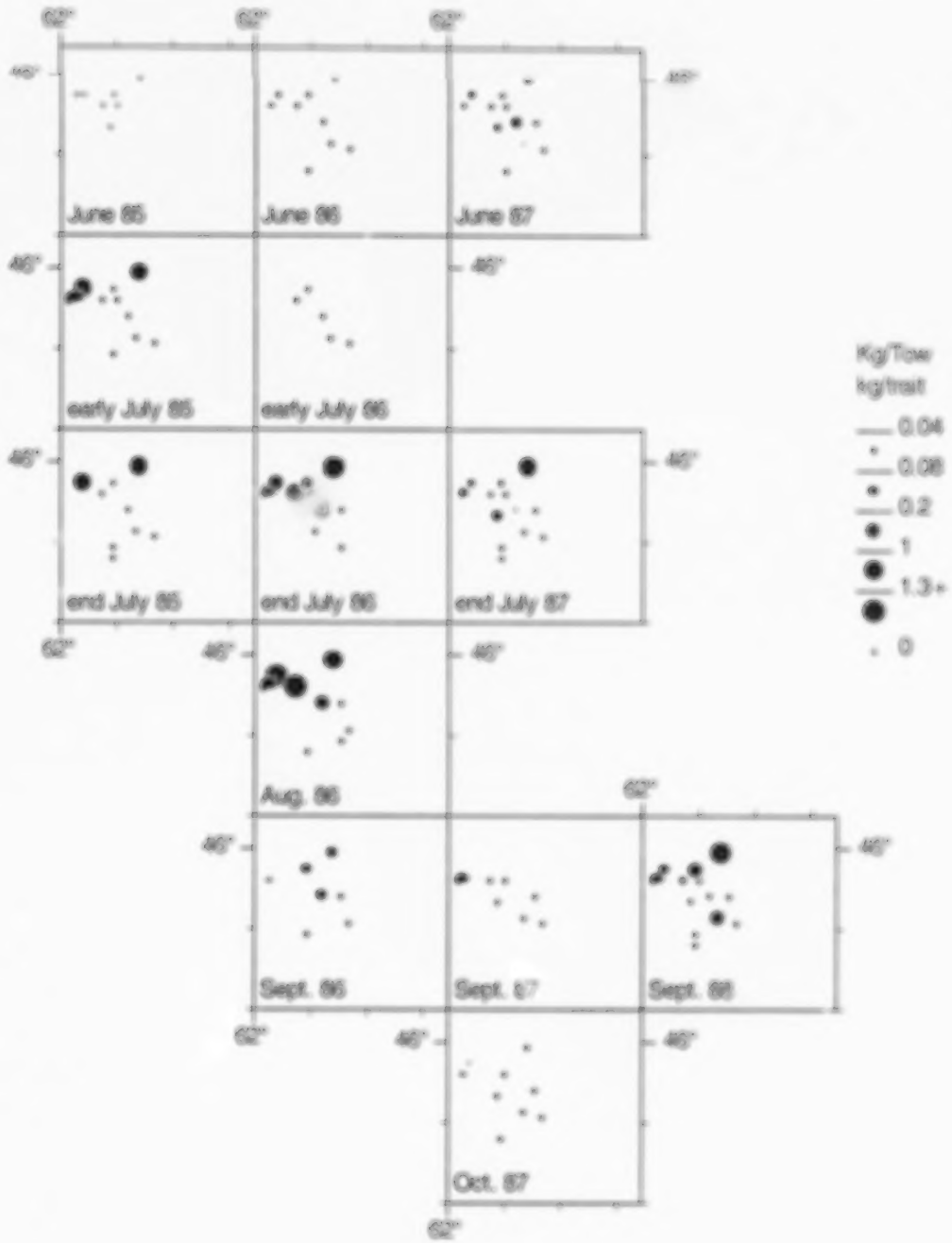

Figure 6a. St. George's Bay seasonal distribution of catches (kg/tow) of Sneaketblenny, *Lumpenus lampretaeformis*.

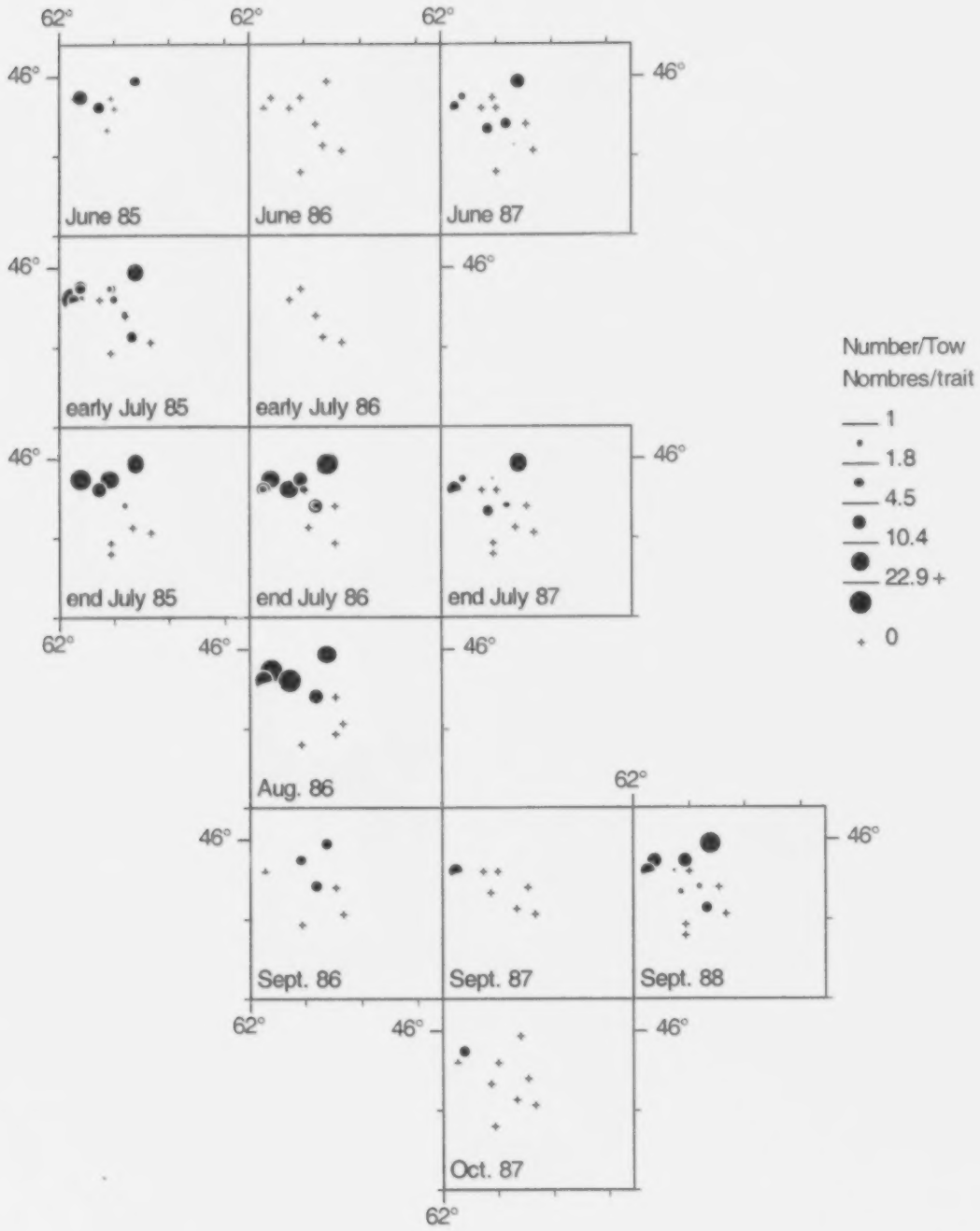

Figure 8b. St. George's Bay seasonal distribution of catches (number/tow) of Snakeblenny, *Lumpenus lampretaeformis*.

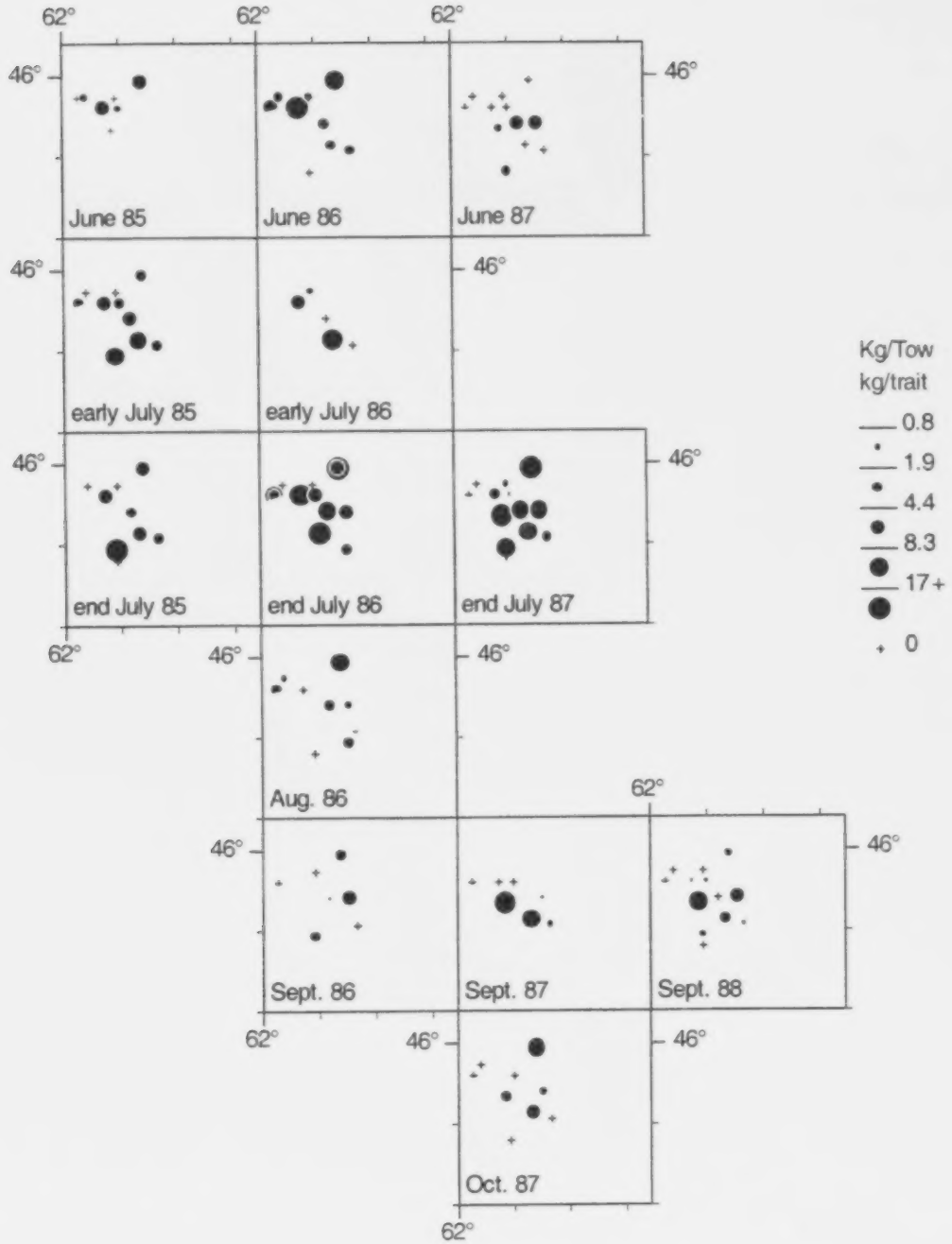

Figure 9a. St. George's Bay seasonal distribution of catches (kg/tow) of Common Ocean Pout, *Zoarces americanus*.

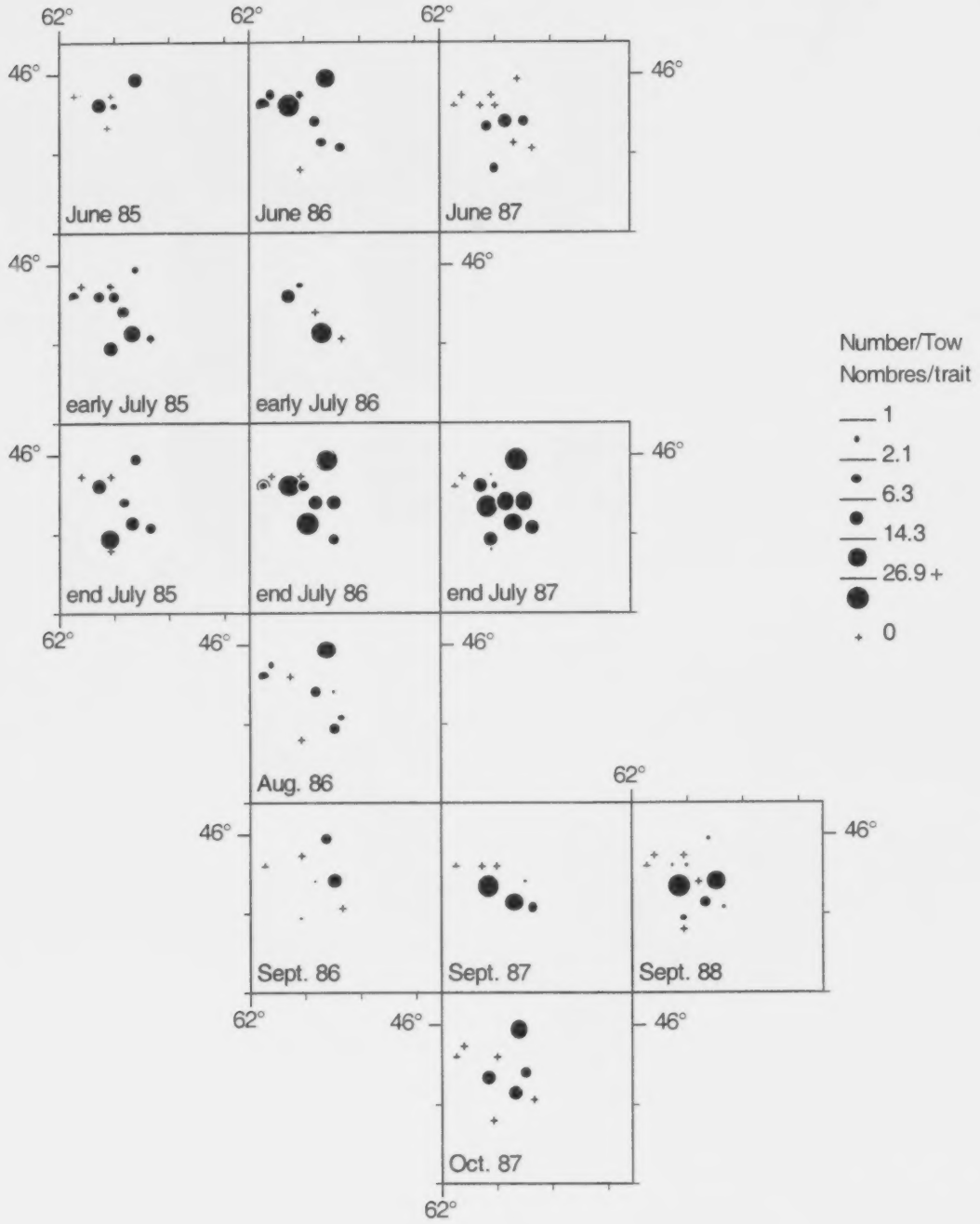

Figure 9b. St. George's Bay seasonal distribution of catches (number/tow) of Common Ocean Pout, *Zoarces americanus*.

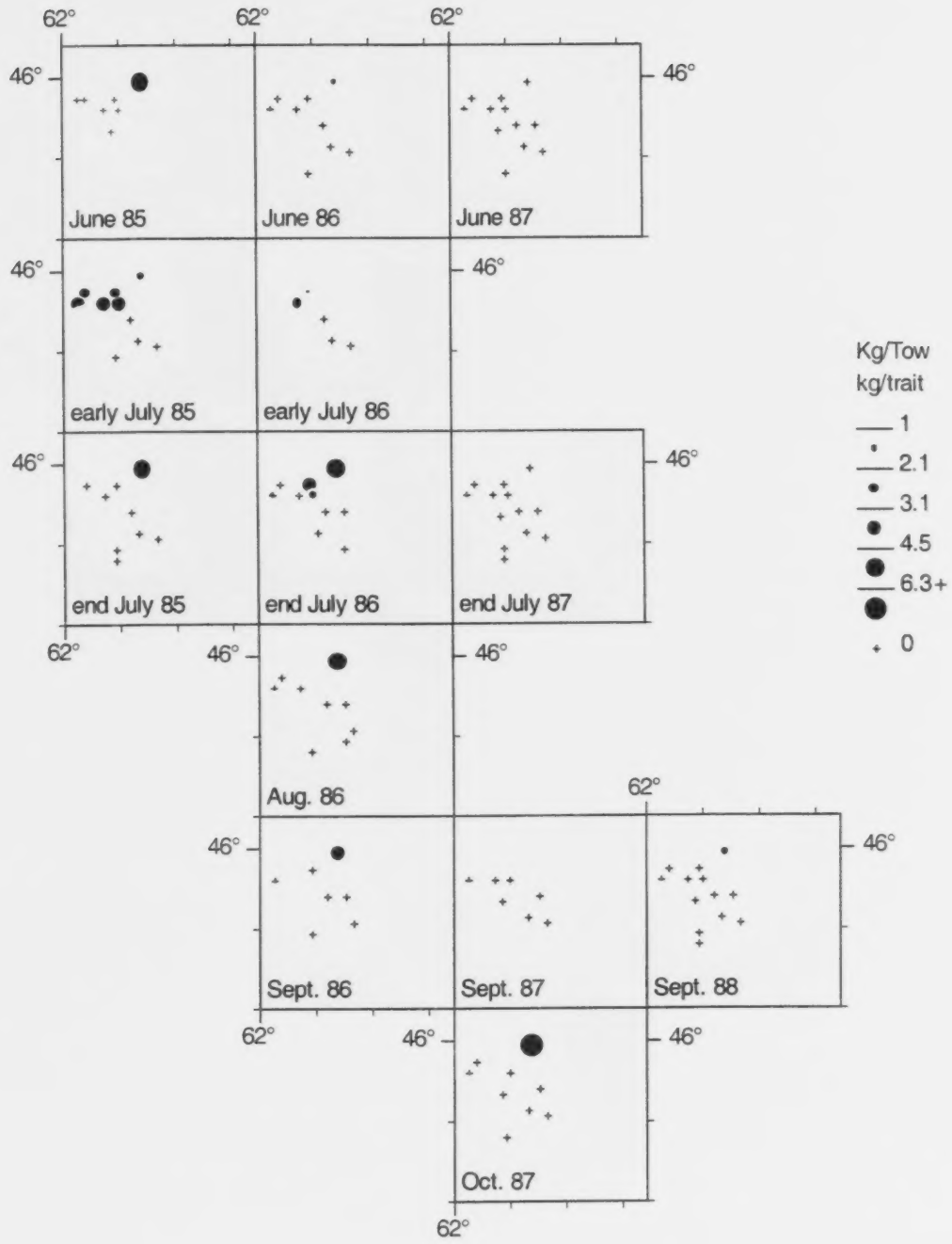

Figure 10a. St. George's Bay seasonal distribution of catches (kg/tow) of Witch Flounder, *Glyptocephalus cynoglossus*.

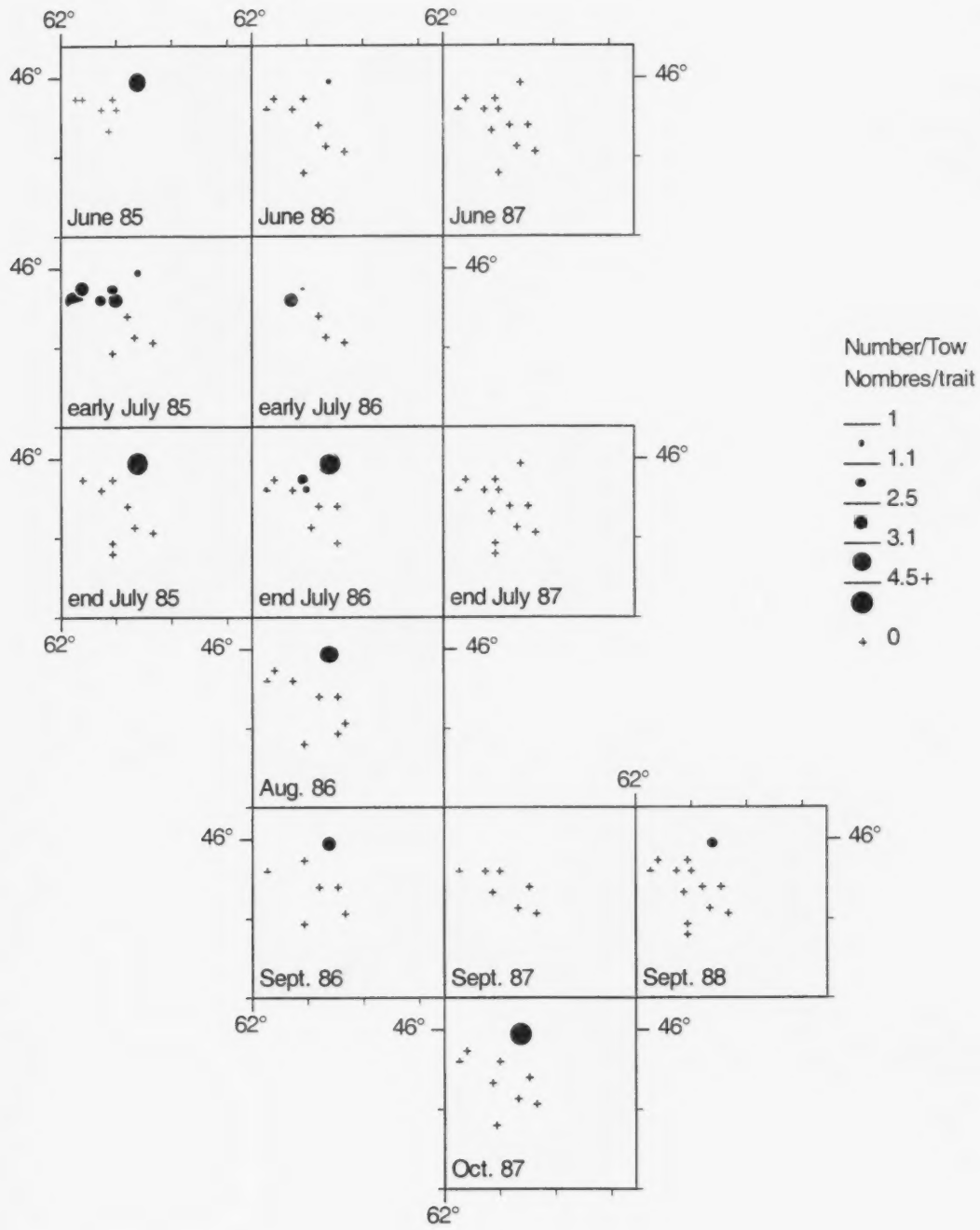

Figure 10b. St. George's Bay seasonal distribution of catches (number/tow) of Witch Flounder, *Glyptocephalus cynoglossus.*

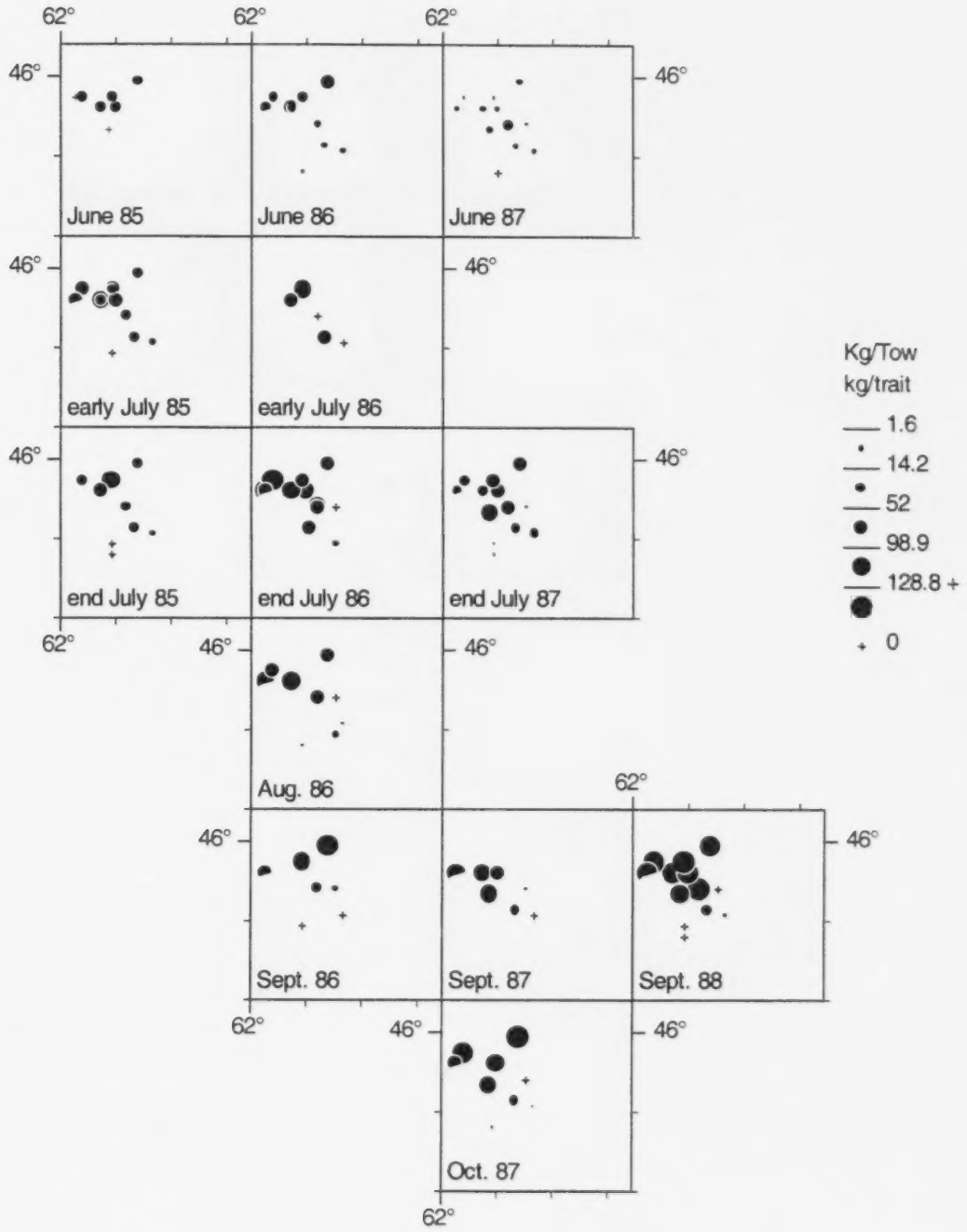

Figure 11a. St. George's Bay seasonal distribution of catches (kg/tow) of American Plaice, *Hippoglossoides platessoides*.

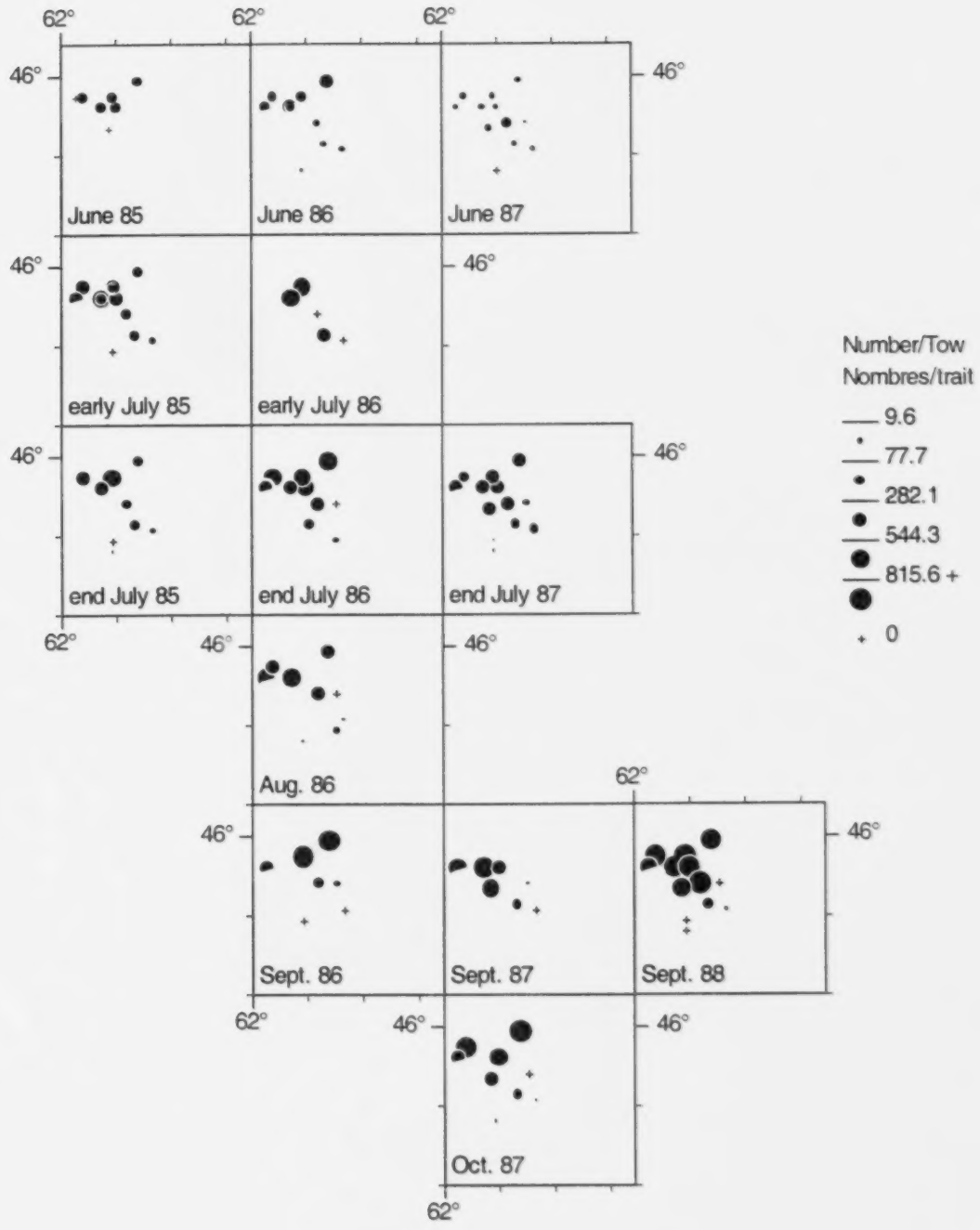

Figure 11b. St. George's Bay seasonal distribution of catches (number/tow) of American Plaice, *Hippoglossoides platessoides*.

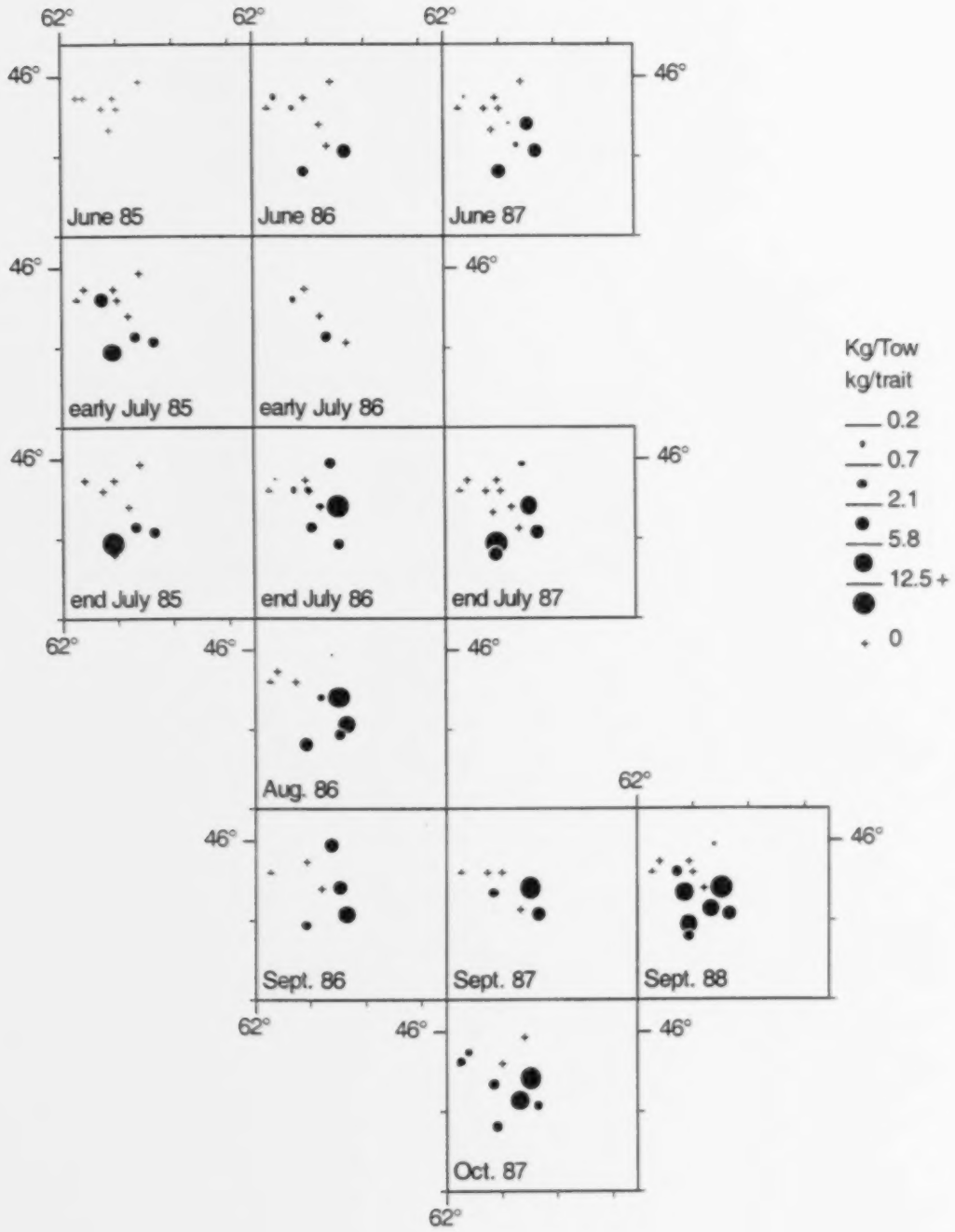

Figure 12a. St. George's Bay seasonal distribution of catches (kg/tow) of Yellowtail Flounder, *Limanda ferruginea*.

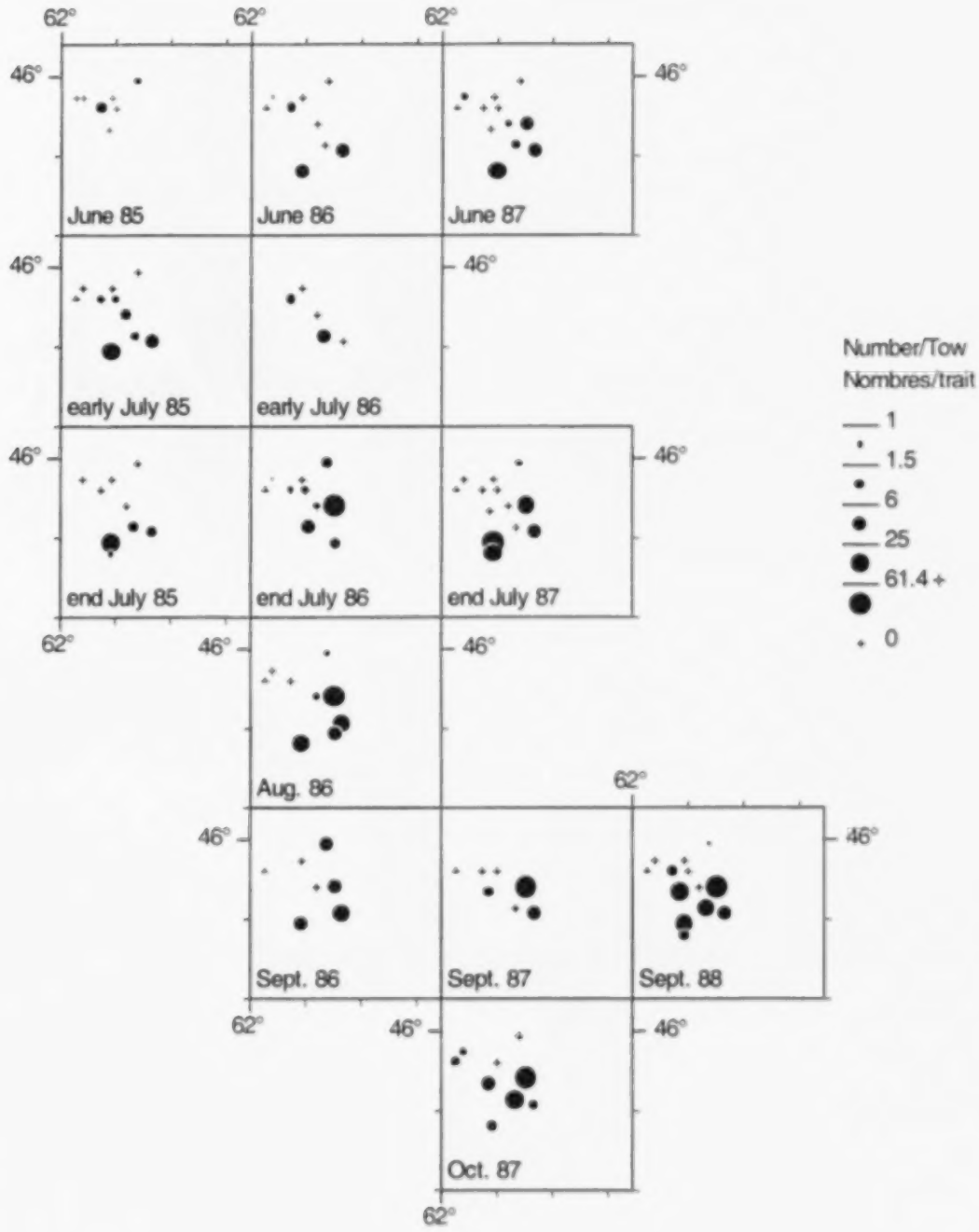

Figure 12b. St. George's Bay seasonal distribution of catches (number/tow) of Yellowtail Flounder, *Limanda ferruginea*.

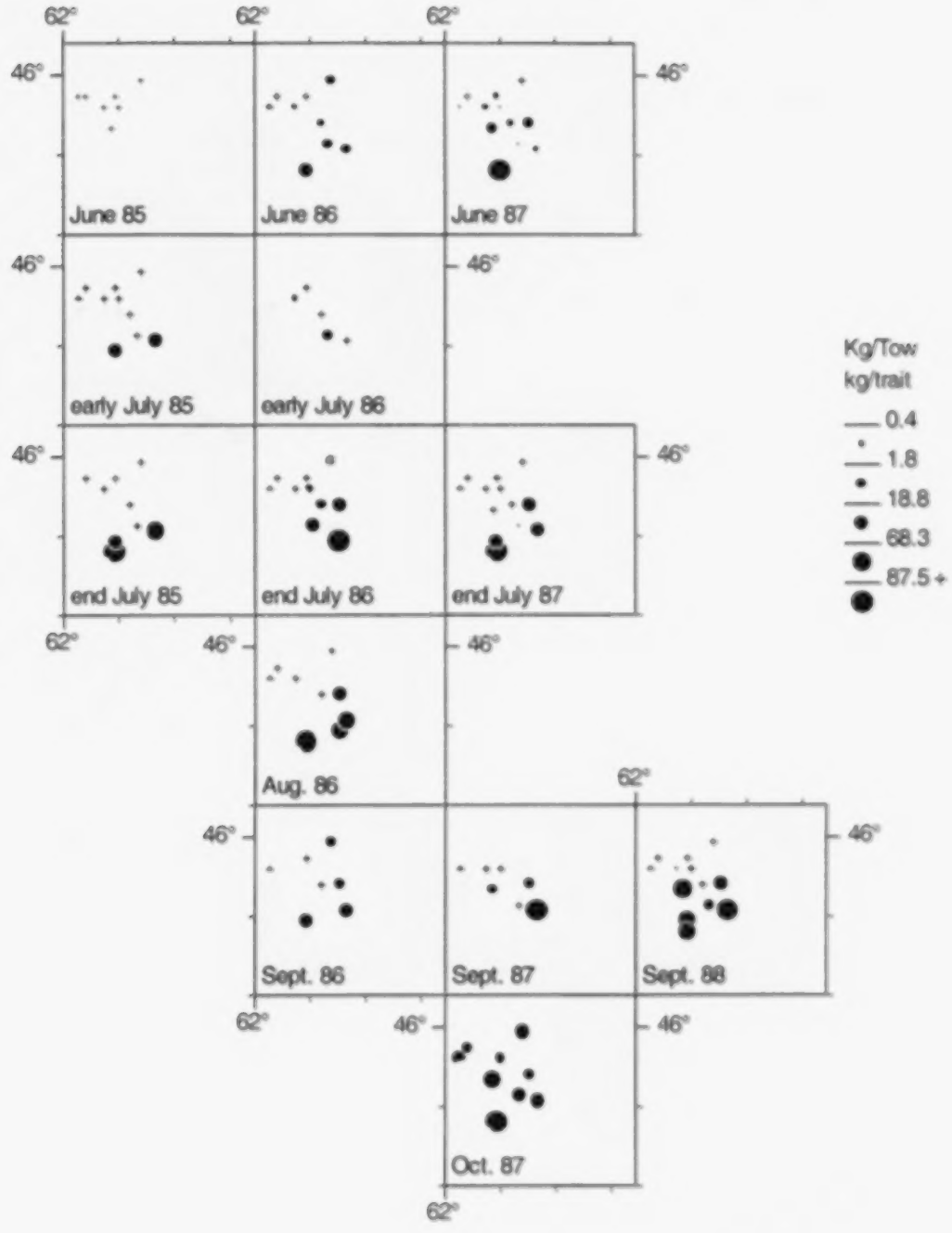

Figure 13a. St. George's Bay seasonal distribution of catches (kg/tow) of Winter Flounder, *Pseudopleuronectes americanus*.

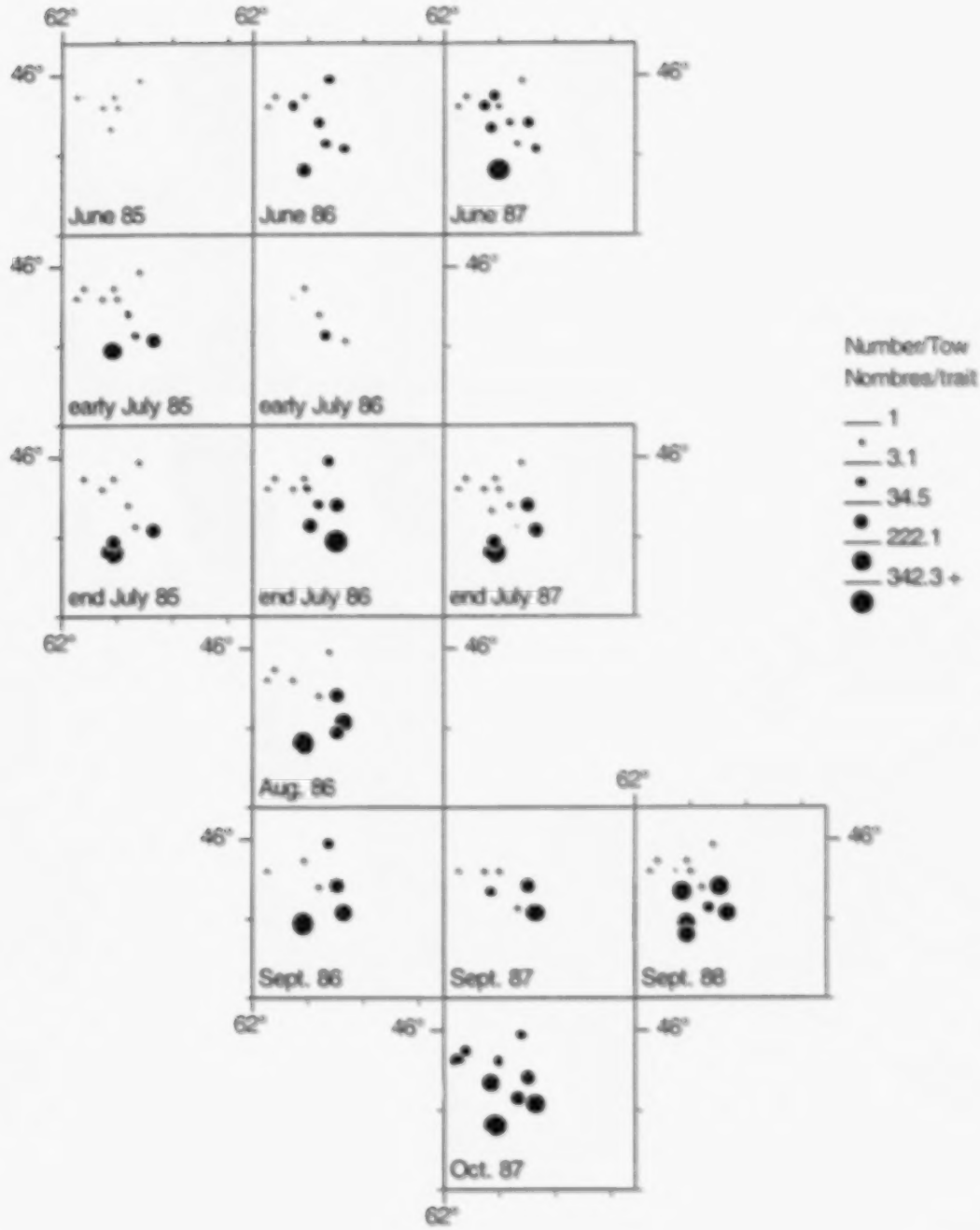

Figure 13b. St. George's Bay seasonal distribution of catches (number/tow) of Winter Flounder, *Pseudopleuronectes americanus*.

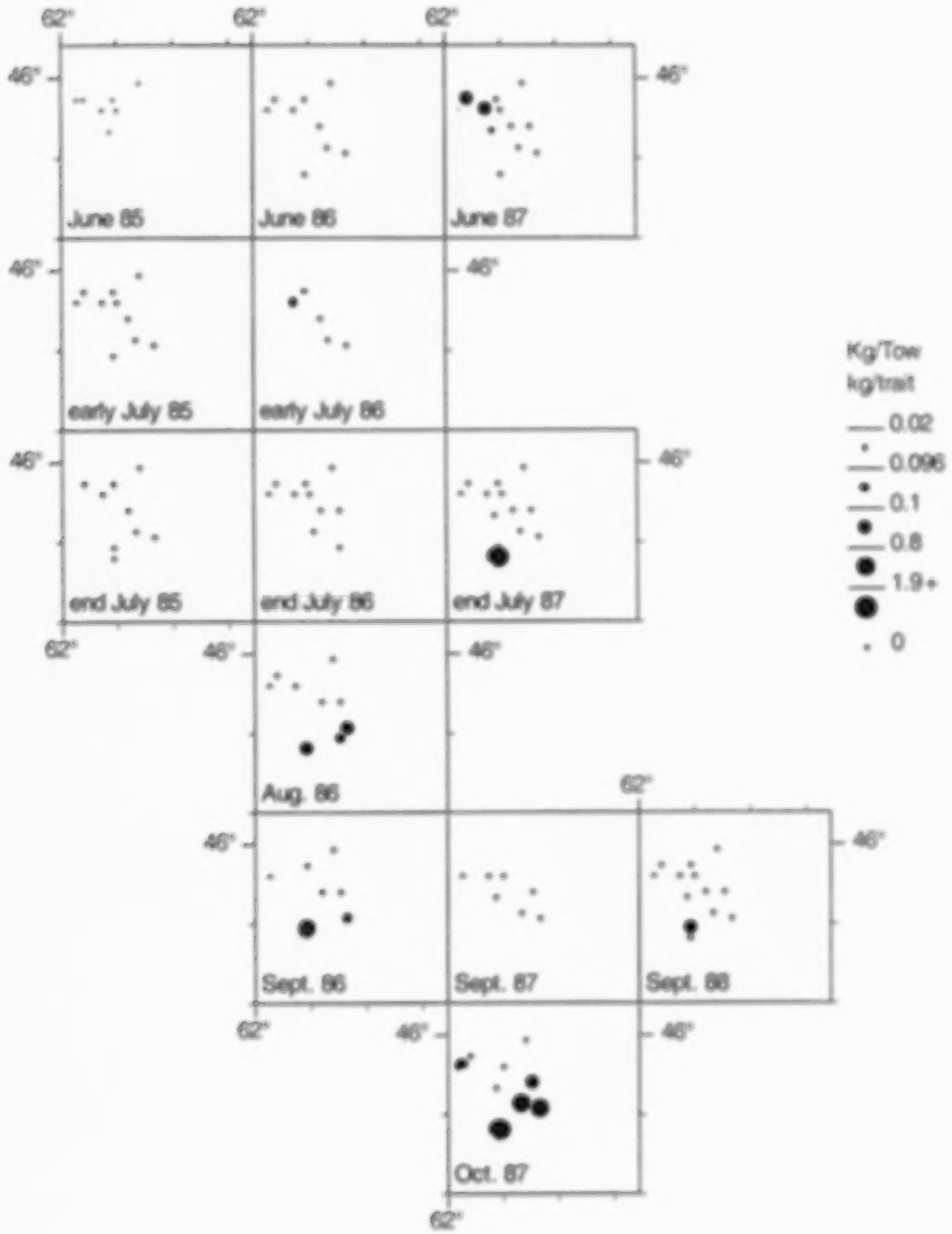

Figure 14a. St. George's Bay seasonal distribution of catches (kg/tow) of Windowpane, *Scophthalmus aquosus*.

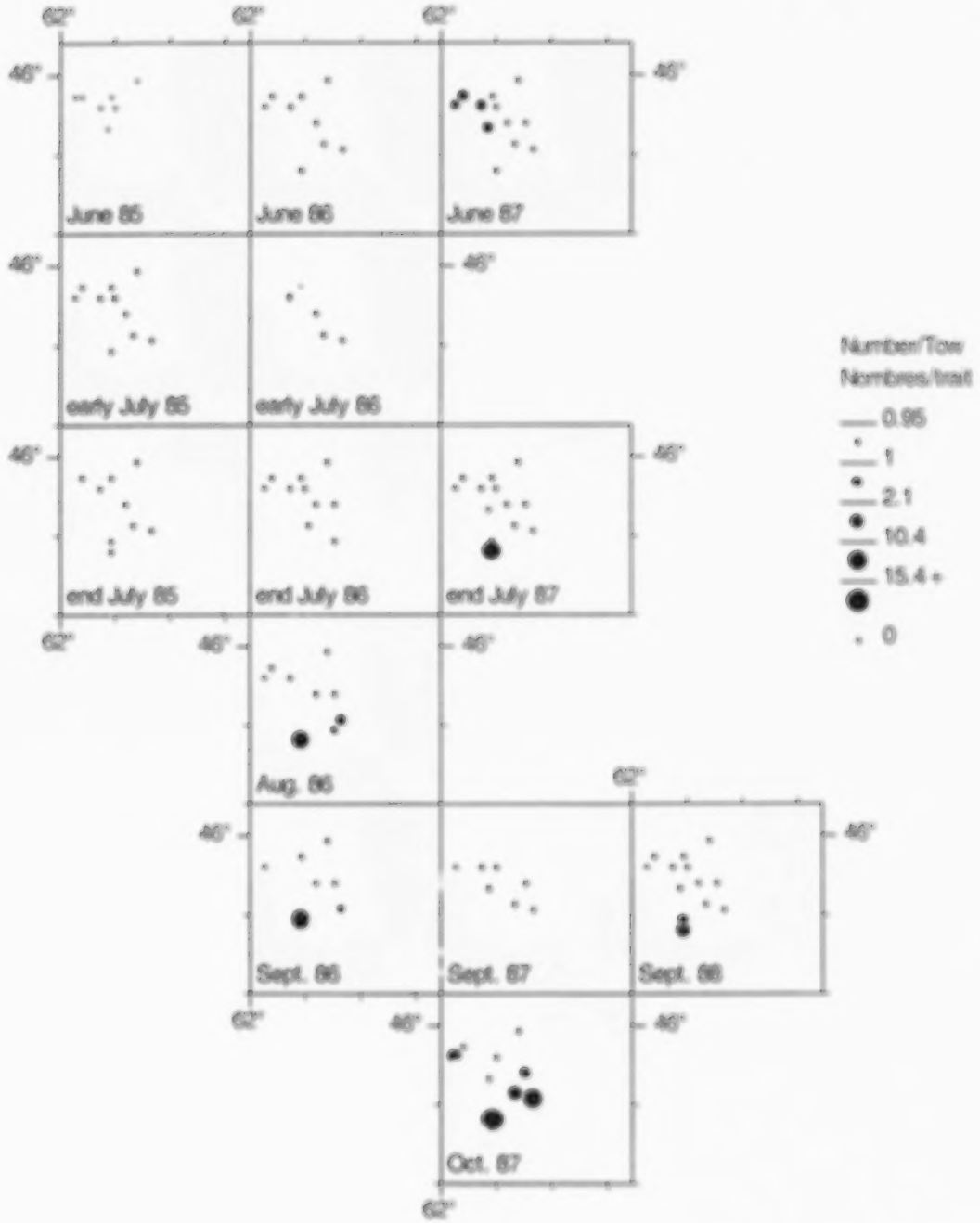

Figure 14b. St. George's Bay seasonal distribution of catches (number/tow) of Windowpane, *Scophthalmus aquosus*.

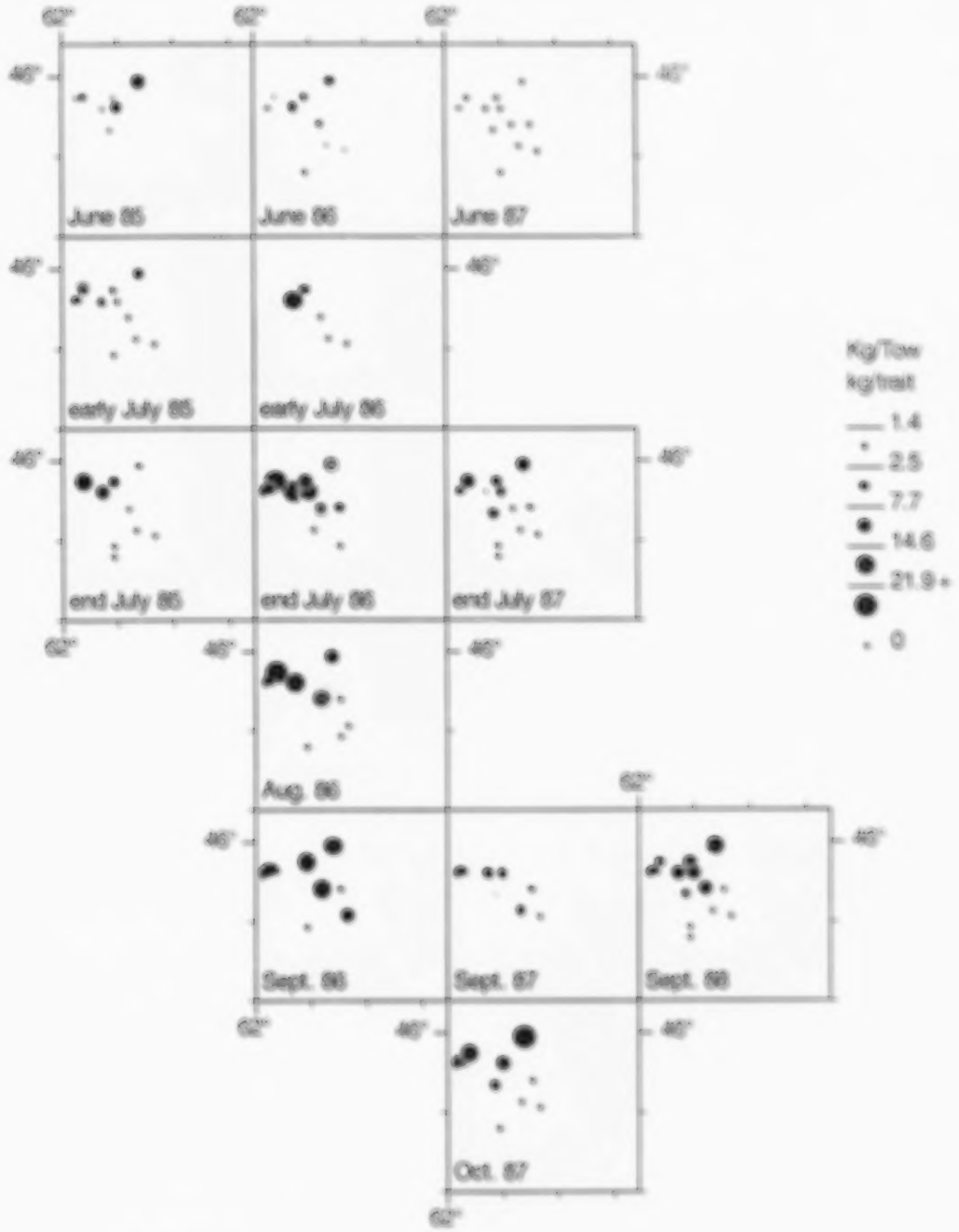

Figure 15a. St. George's Bay seasonal distribution of catches (kg/tow) of Thorny Skate, *Amblyraja radiata*.

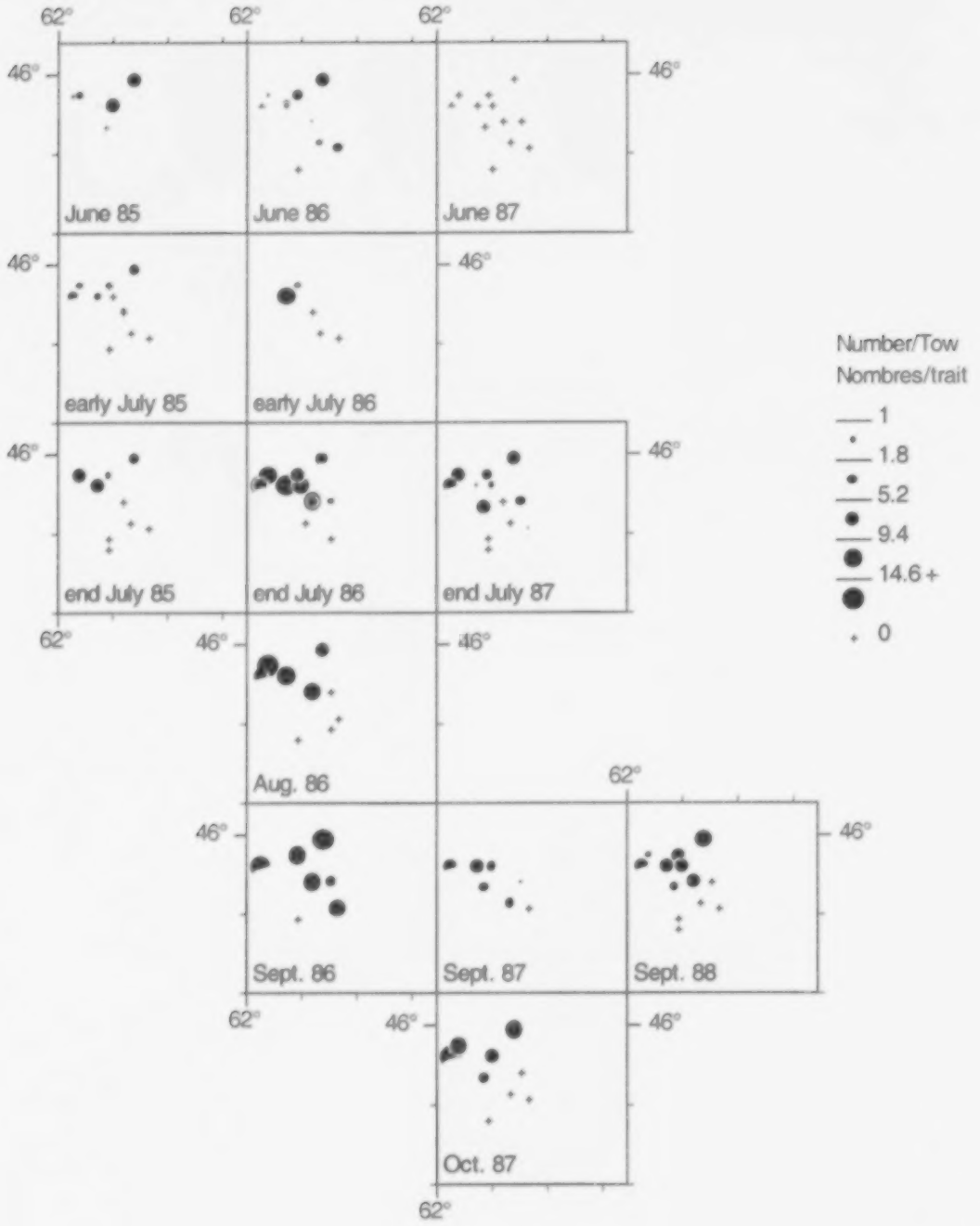

Figure 15b. St. George's Bay seasonal distribution of catches (number/tow) of Thorny Skate, *Amblyraja radiata*.

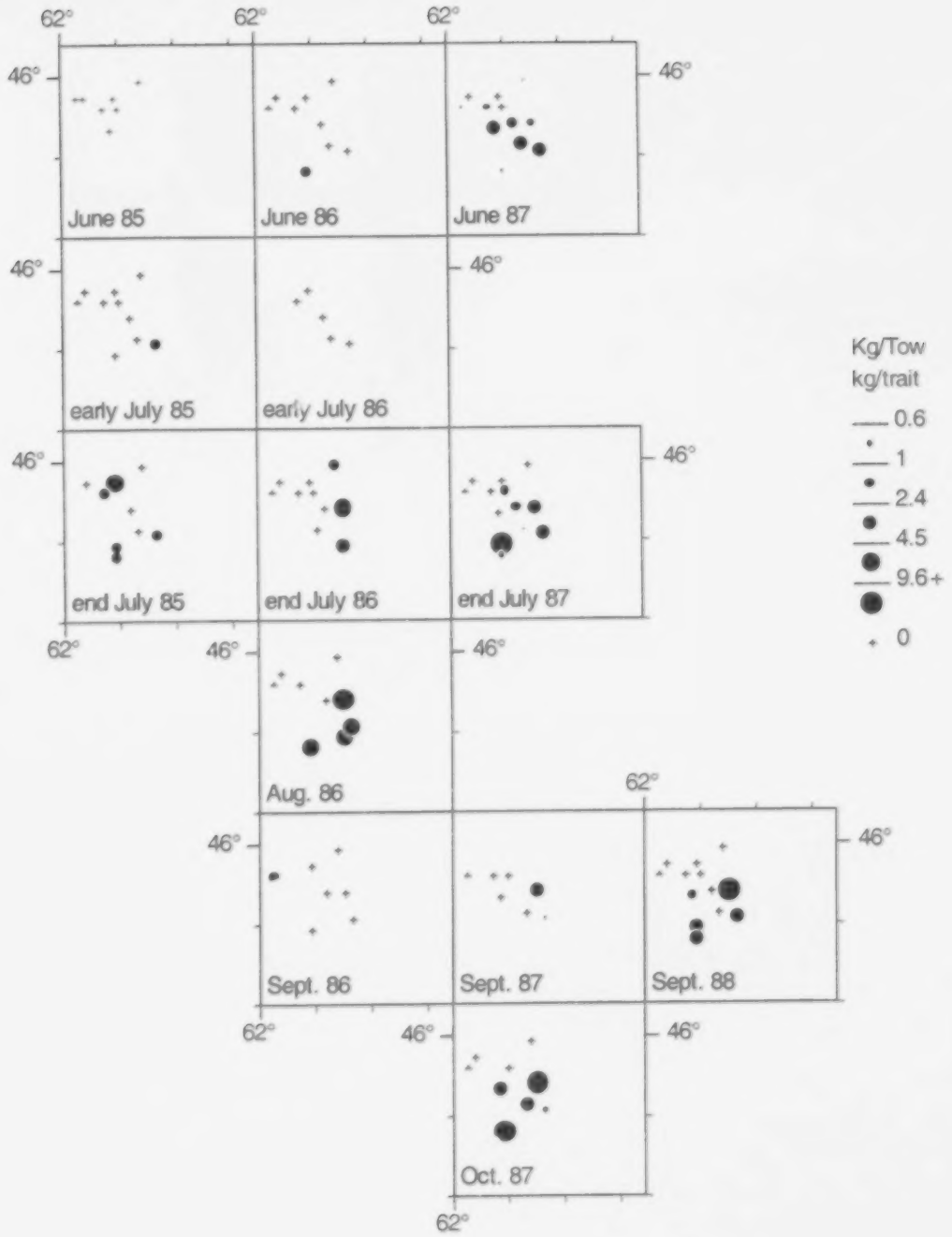

Figure 16a. St. George's Bay seasonal distribution of catches (kg/tow) of Winter Skate, *Leucoraja ocellata*.

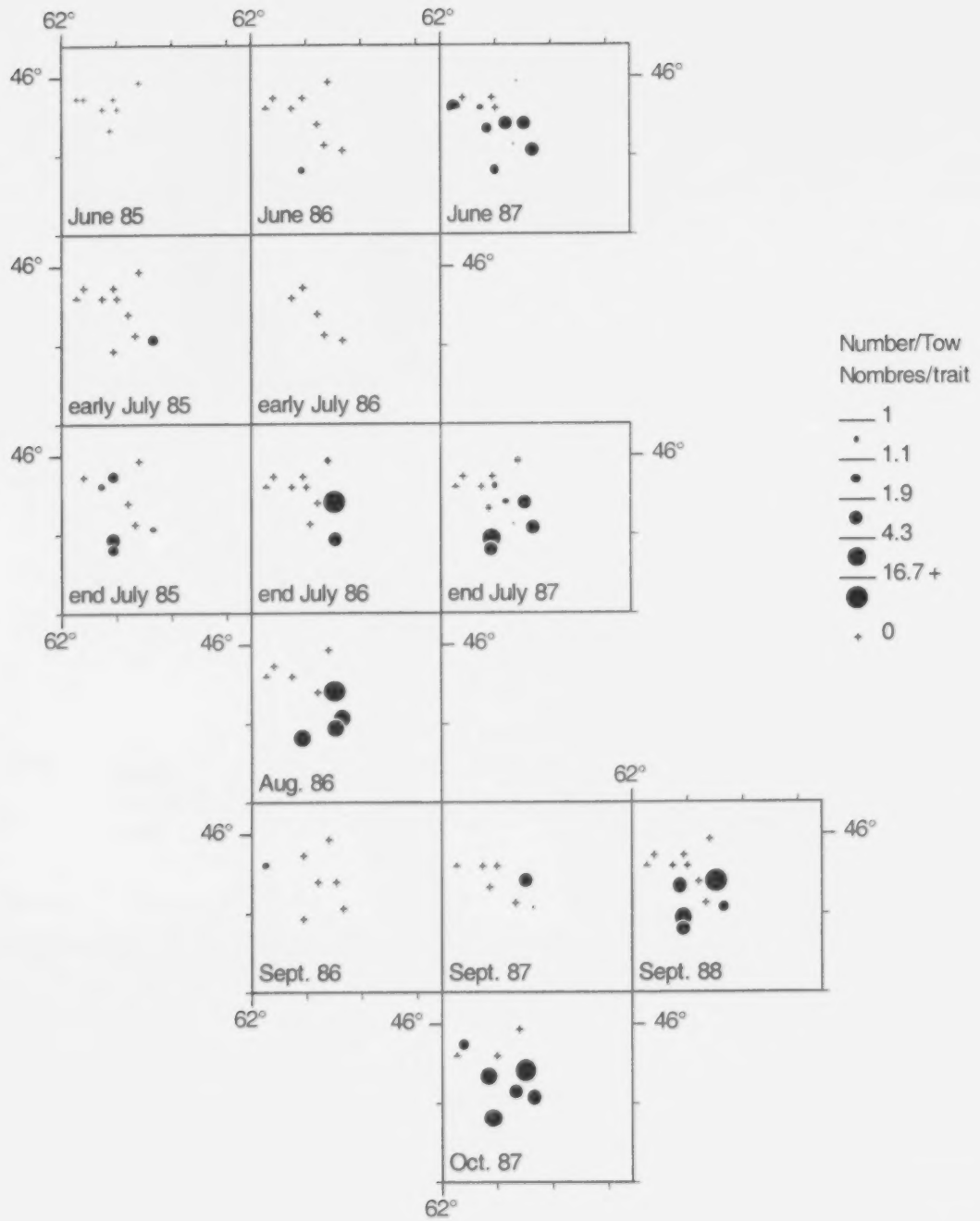

Figure 16b. St. George's Bay seasonal distribution of catches (number/tow) of Winter Skate, *Leucoraja ocellata*.

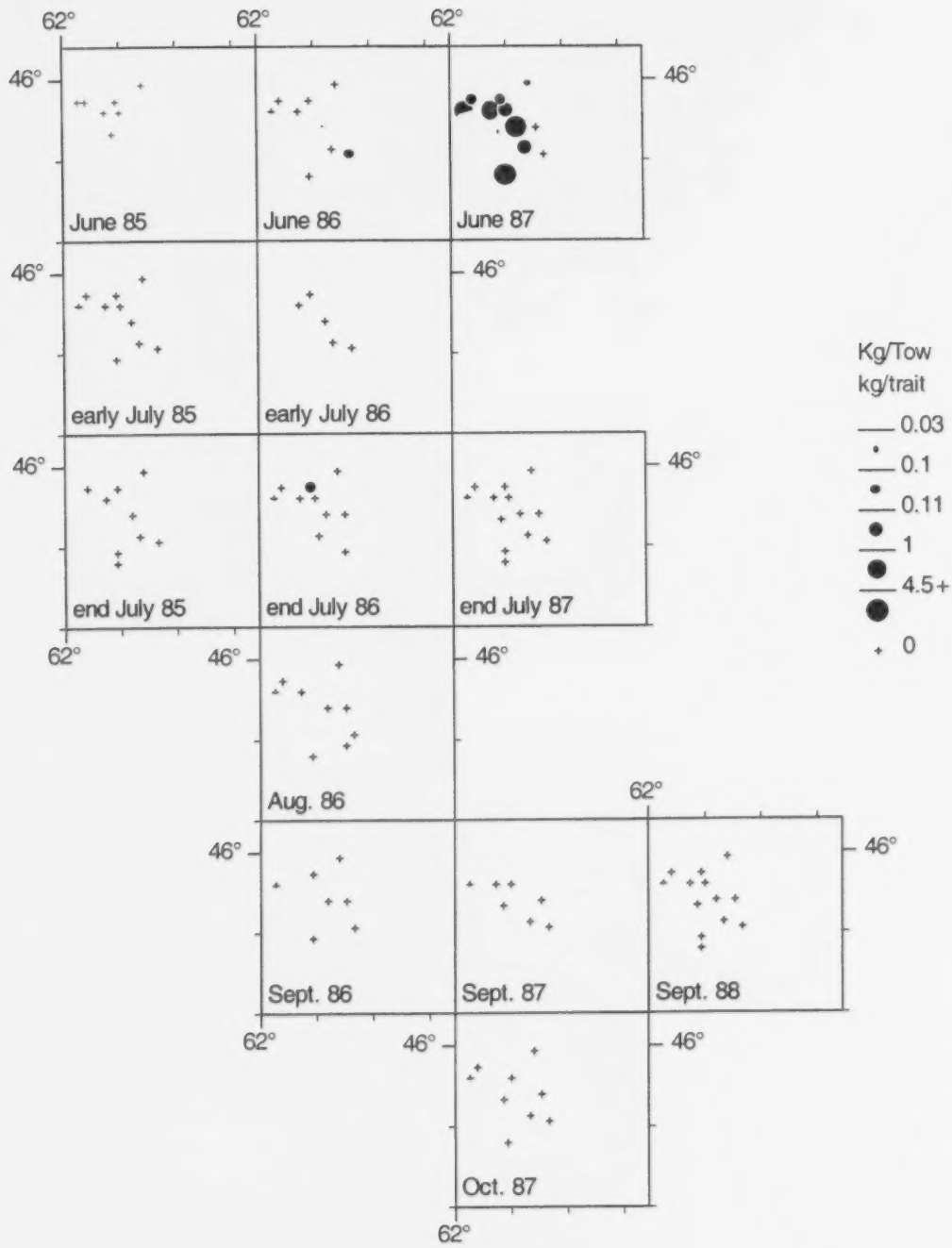

Figure 17a. St. George's Bay seasonal distribution of catches (kg/tow) of Capelin, *Mallotus villosus*.

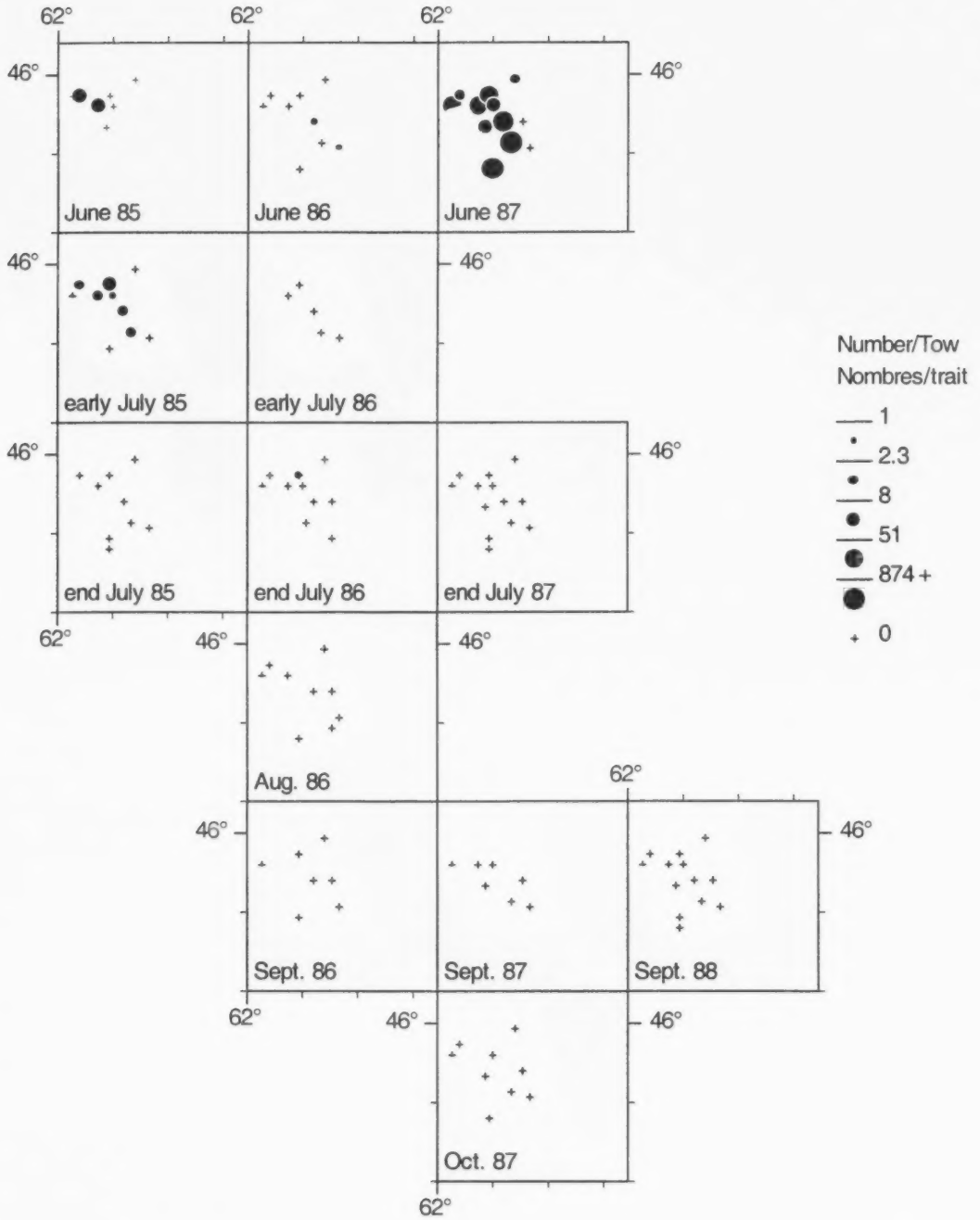

Figure 17b. St. George's Bay seasonal distribution of catches (number/tow) of Capelin, *Mallotus villosus*.

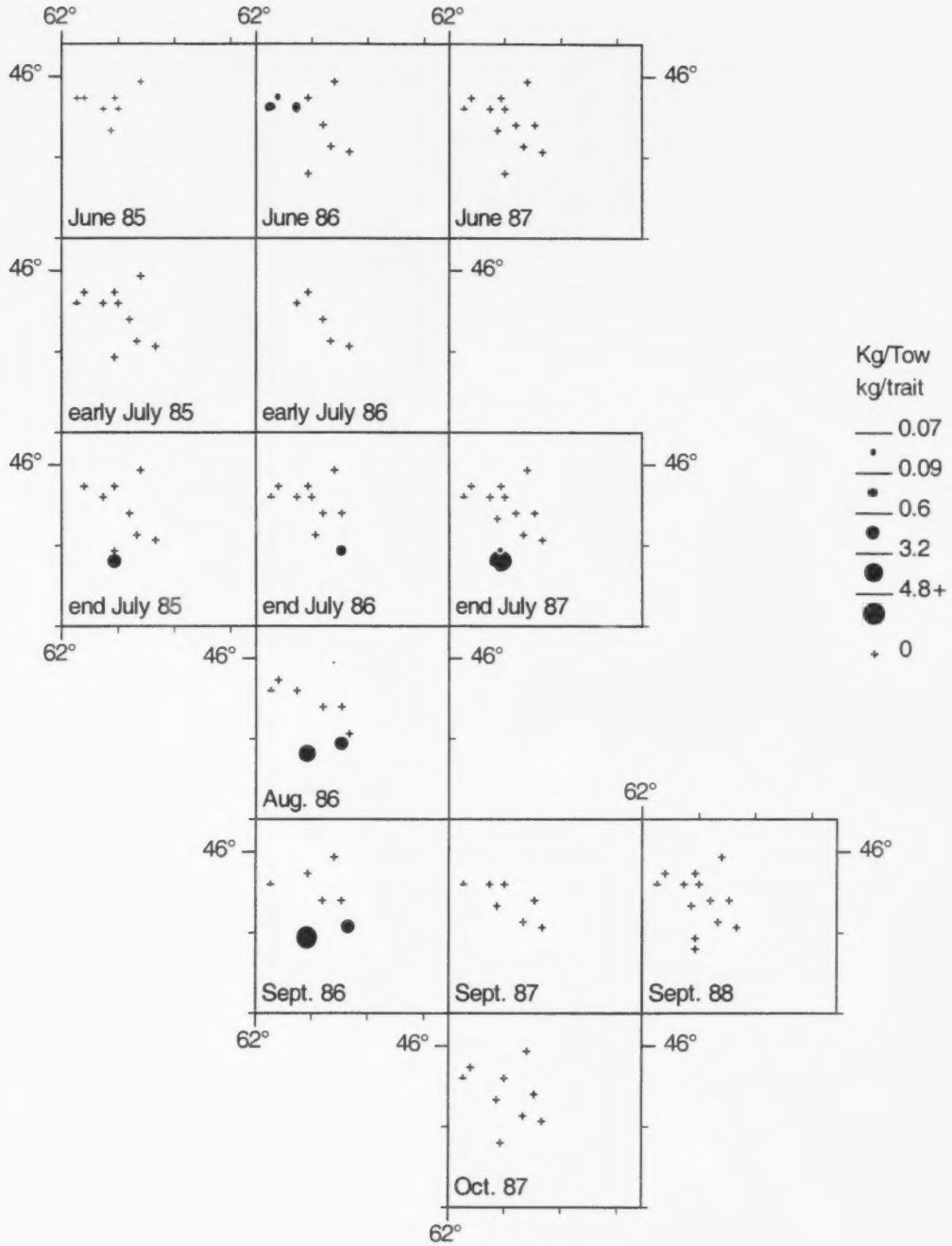

Figure 18a. St. George's Bay seasonal distribution of catches (kg/tow) of Rainbow Smelt, *Osmerus mordax mordax*.

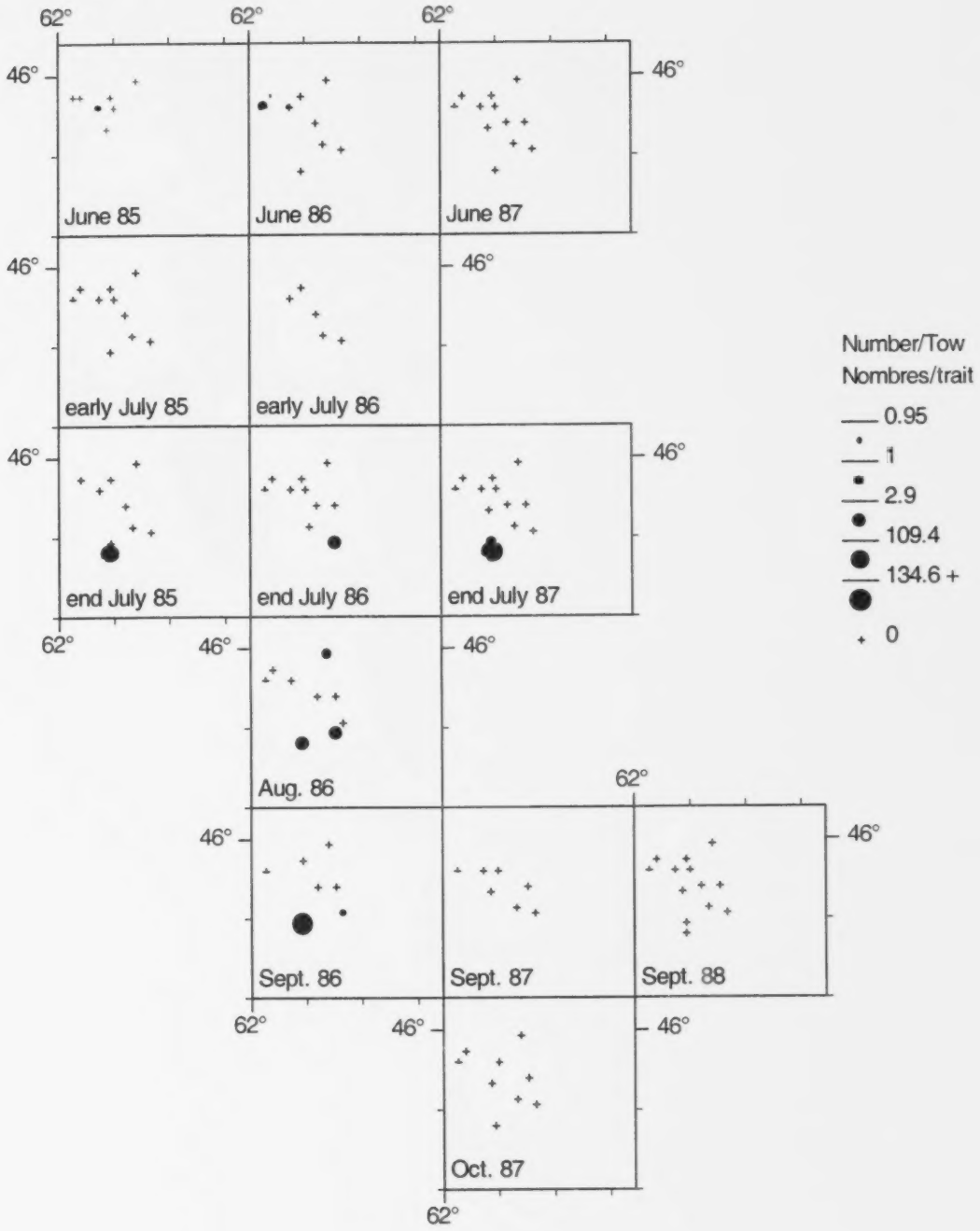

Figure 18b. St. George's Bay seasonal distribution of catches (number/tow) of Rainbow Smelt, *Osmerus mordax mordax.*

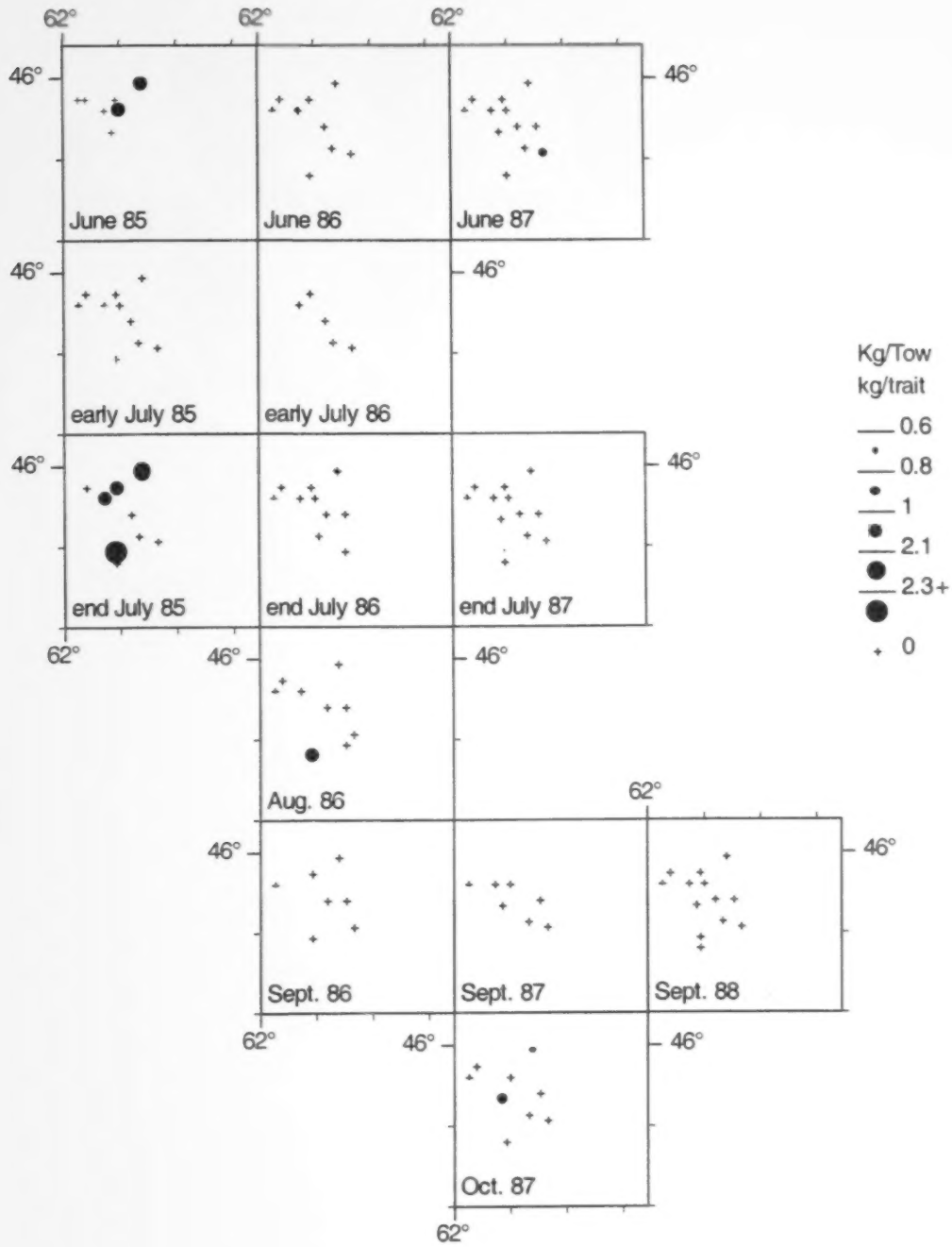

Figure 19a. St. George's Bay seasonal distribution of catches (kg/tow) of Sea Raven, *Hemitripterus americanus*.

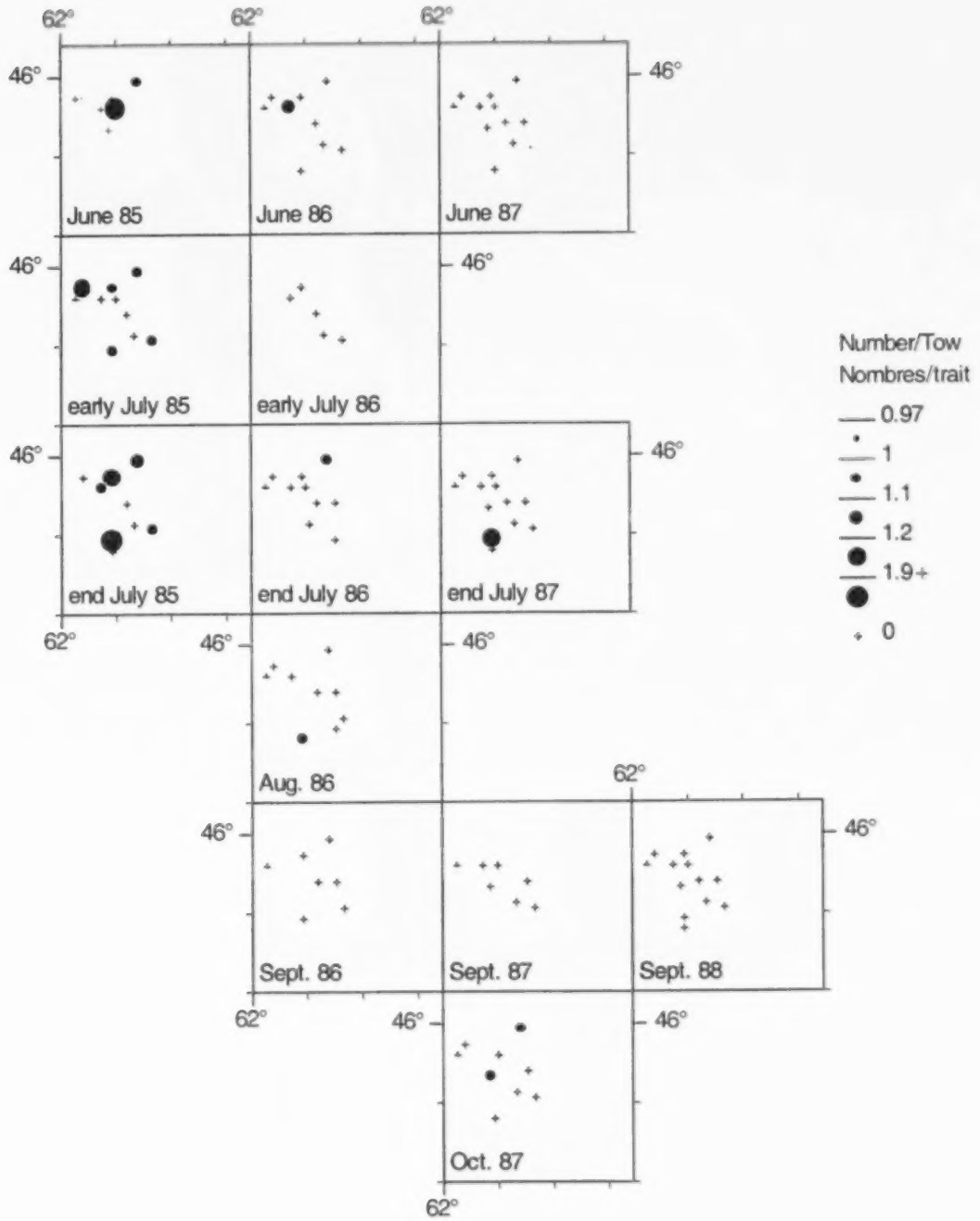

Figure 19b. St. George's Bay seasonal distribution of catches (number/tow) of Sea Raven, *Hemitripterus americanus*.

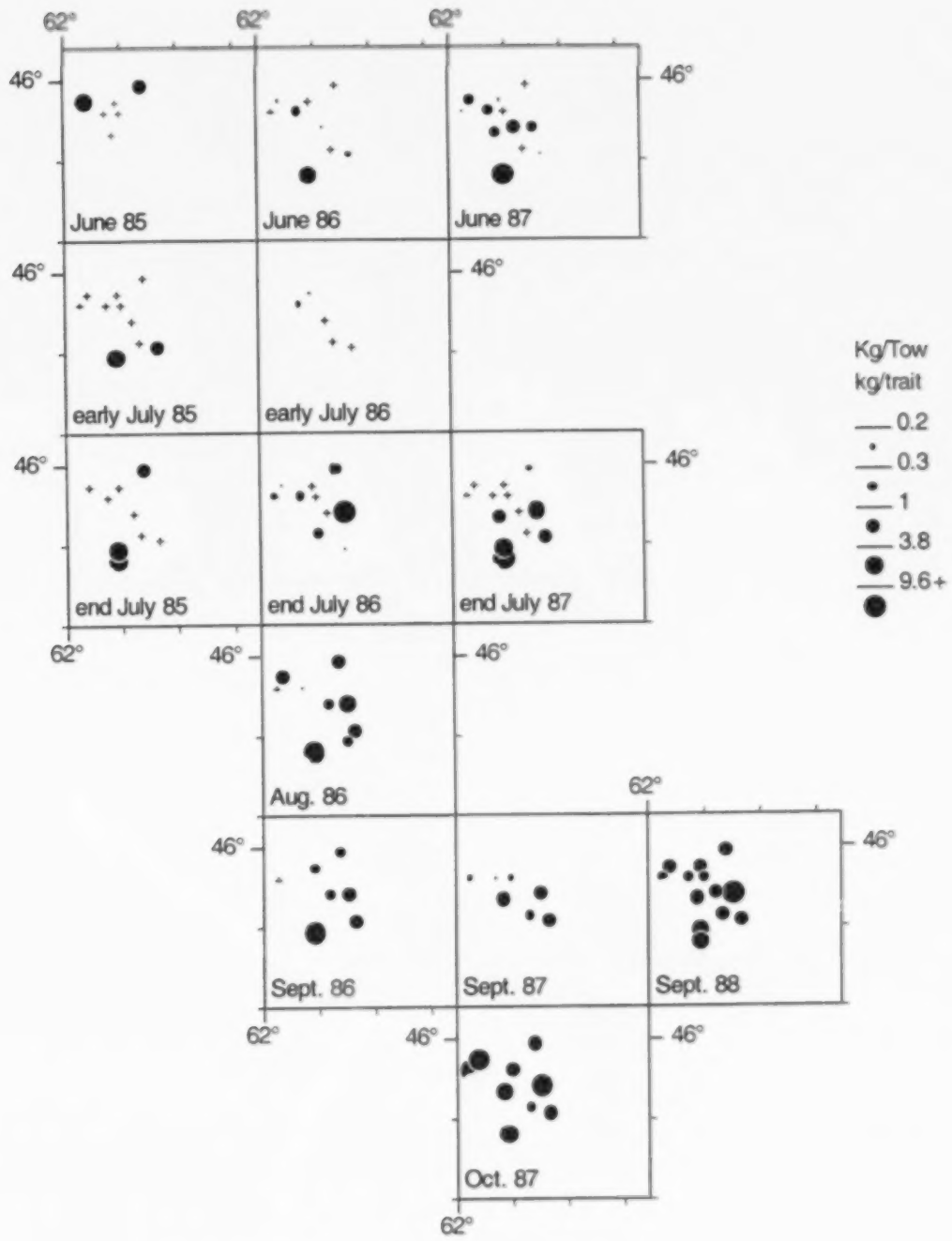

Figure 20a. St. George's Bay seasonal distribution of catches (kg/tow) of Longhorn Sculpin, *Myoxocephalus octodecemspinosus*.

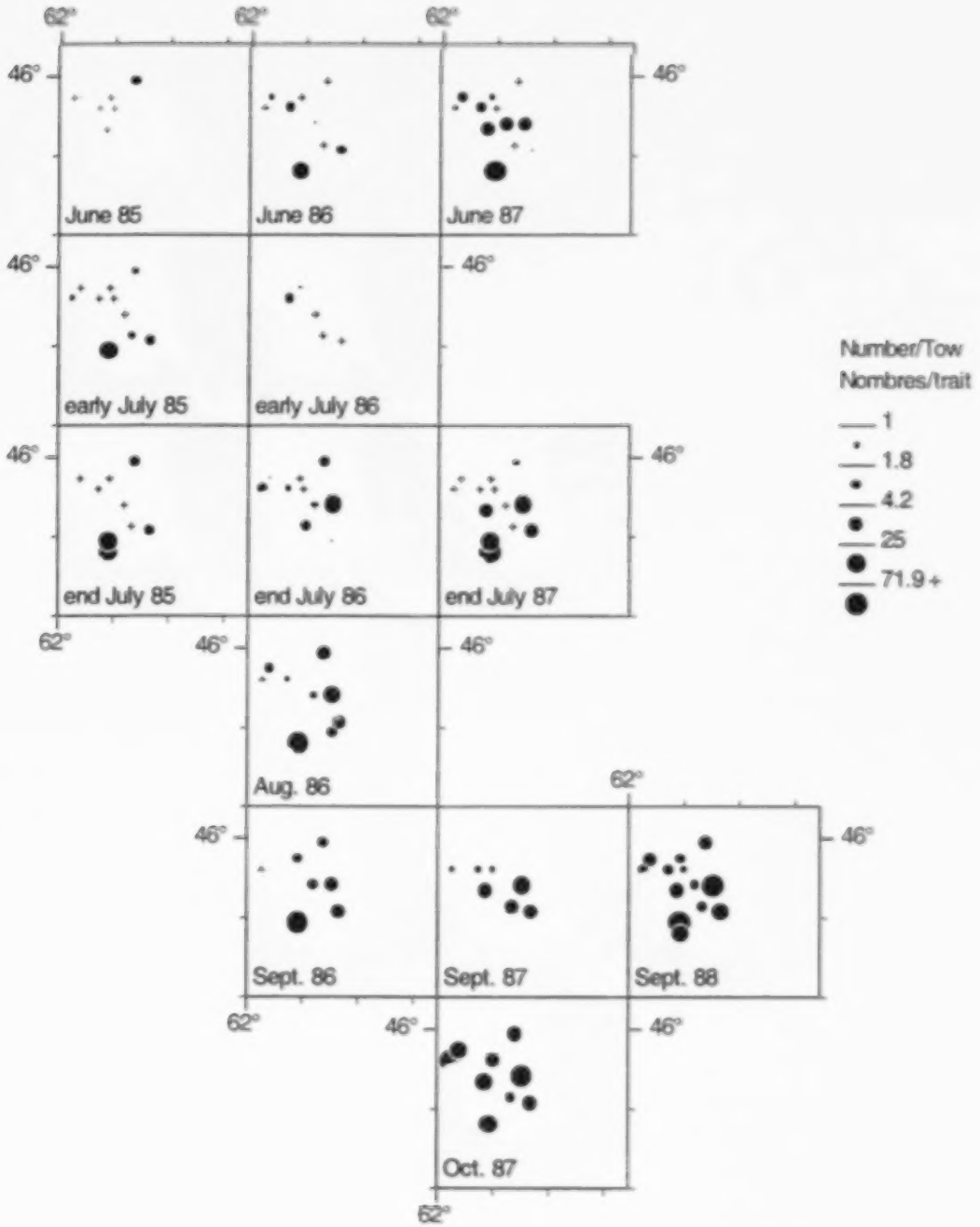

Figure 20b. St. George's Bay seasonal distribution of catches (number/tow) of Longhorn Sculpin, *Myoxocephalus octodecemspinosus*.

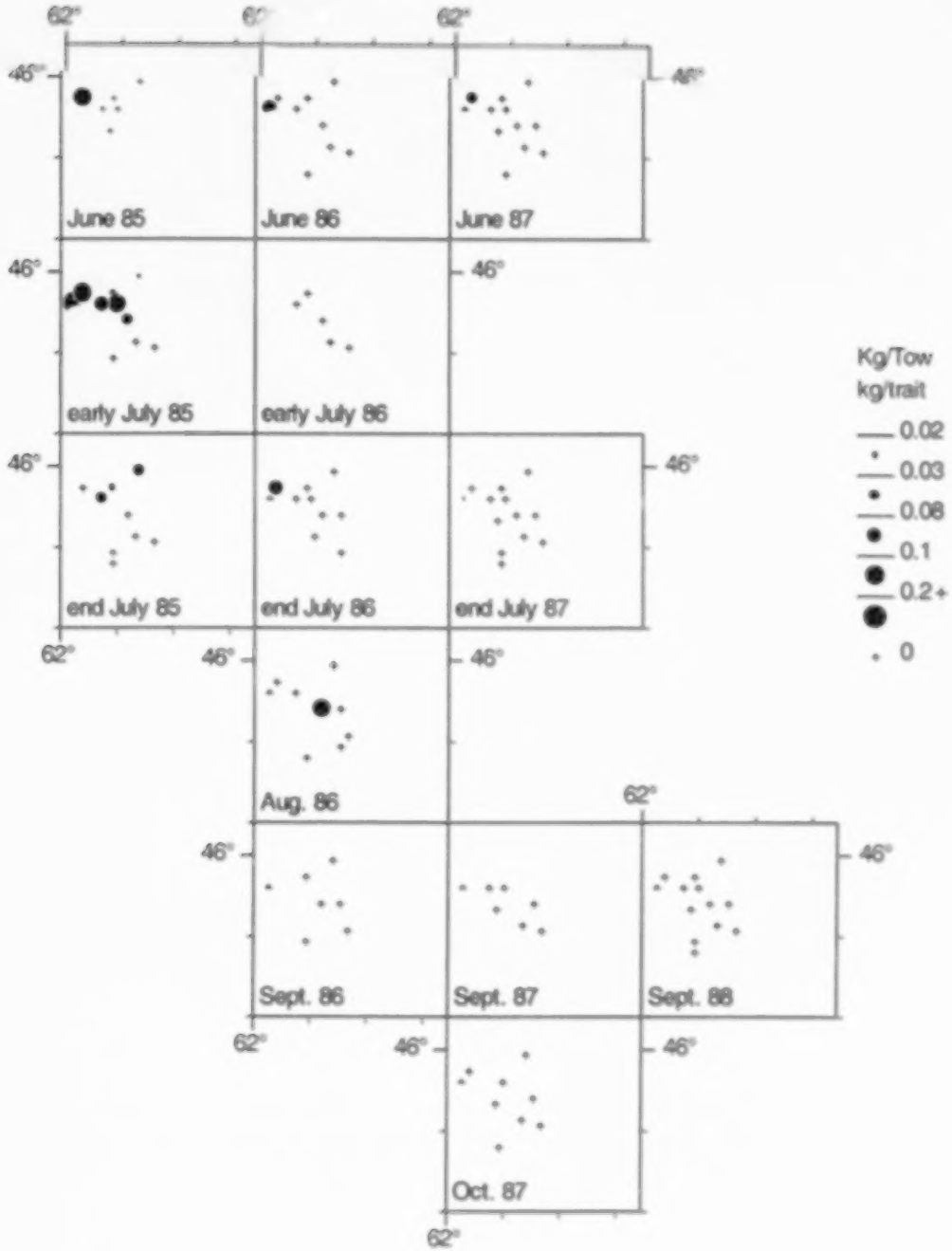

Figure 21. St. George's Bay seasonal distribution of catches (kg/tow) of Pandalid Shrimp, Pandalidae.

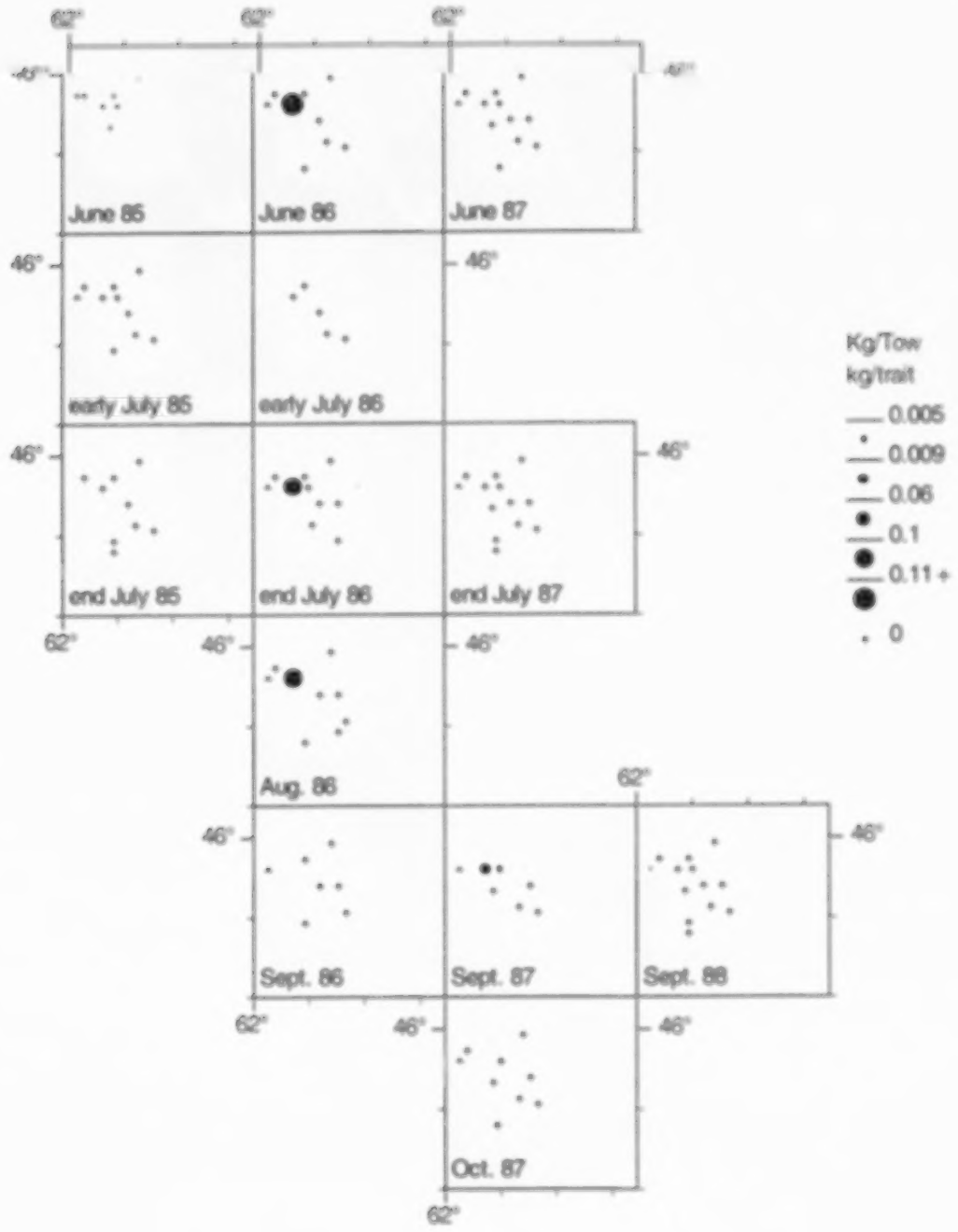

Figure 22. St. George's Bay seasonal distribution of catches (kg/tow) of Snapping Shrimp, Crangonidae.

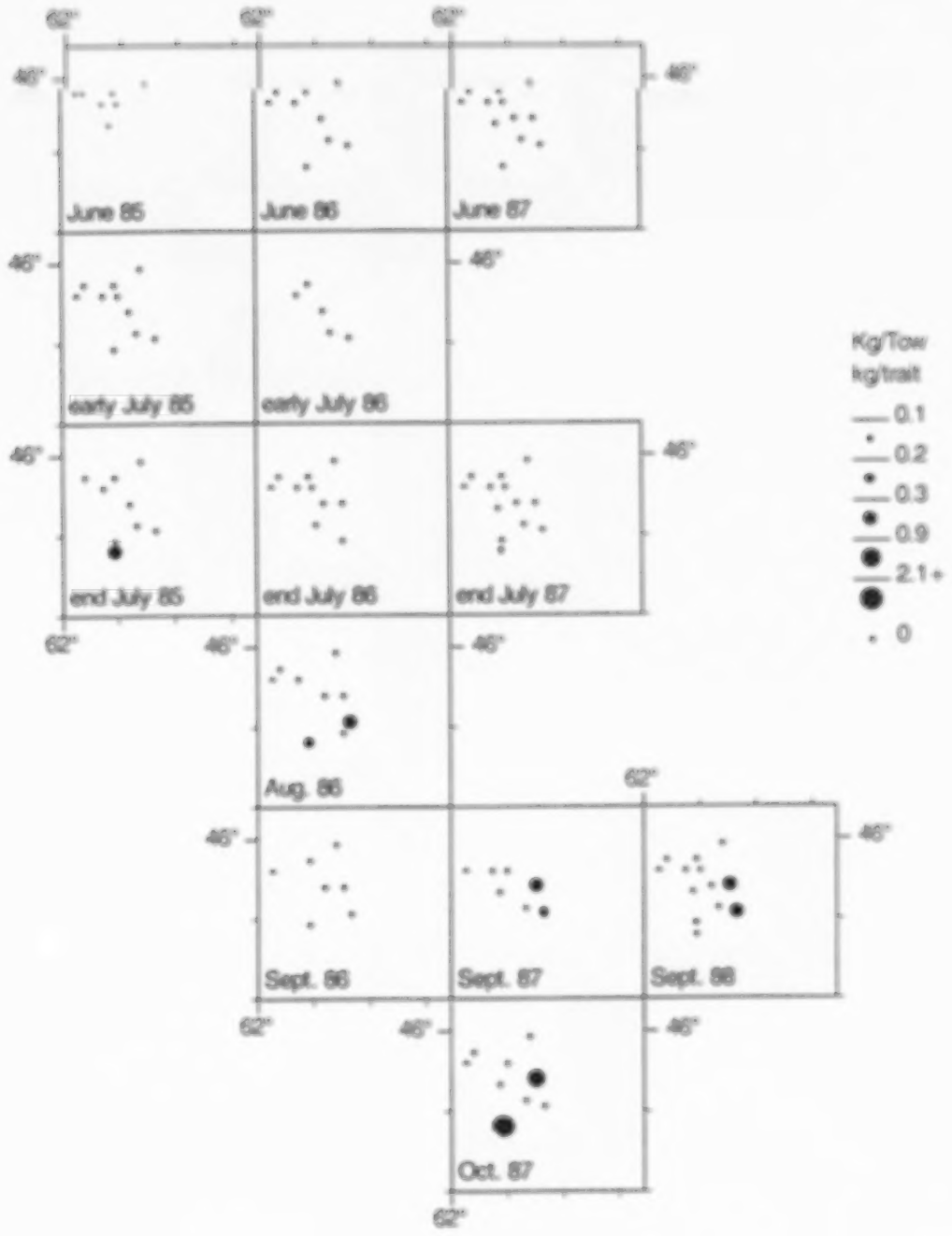

Figure 23. St. George's Bay seasonal distribution of catches (kg/tow) of Atlantic Rock Crab, *Cancer irroratus*.

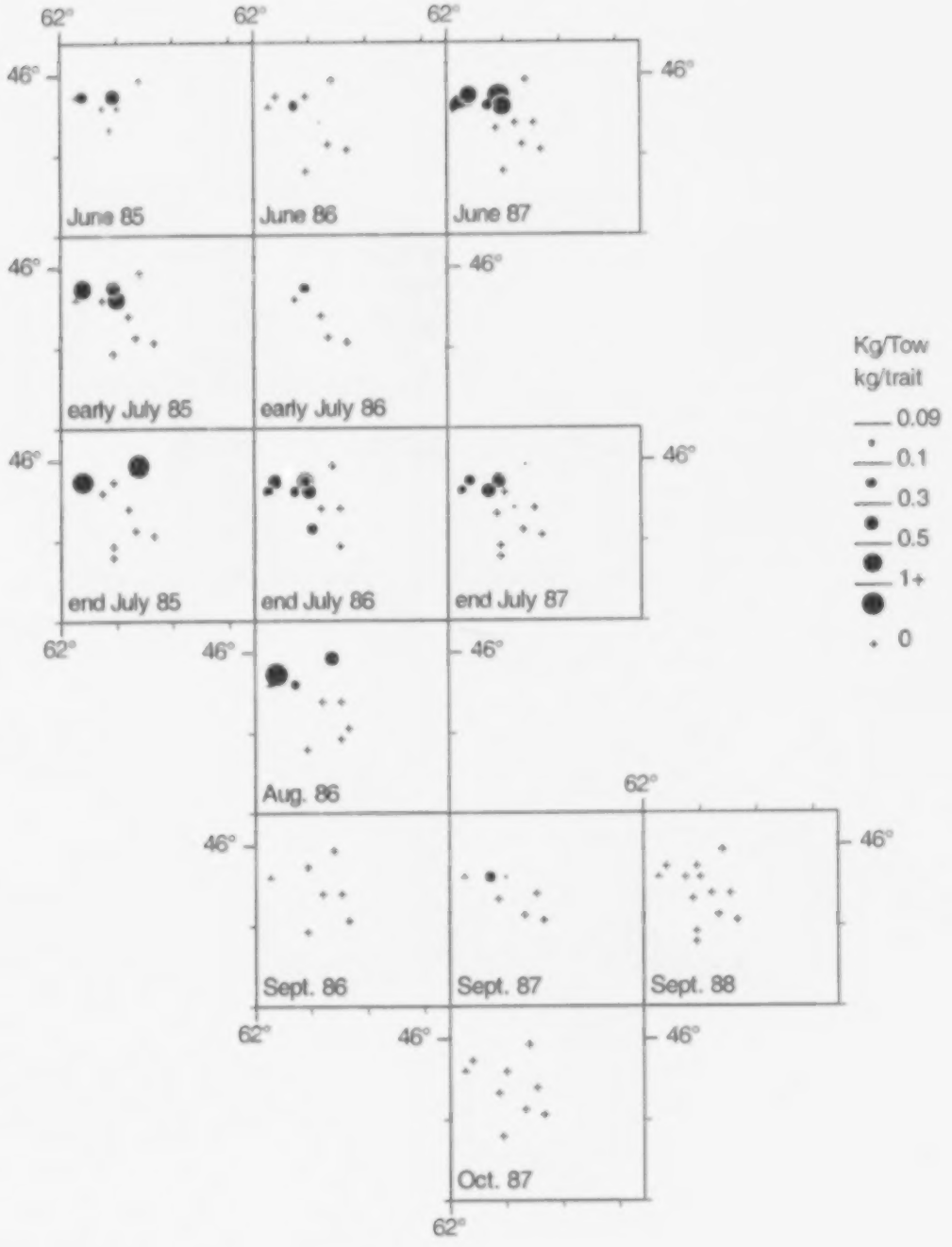

Figure 24. St. George's Bay seasonal distribution of catches (kg/tow) of Toad Crabs, *Hyas sp.*

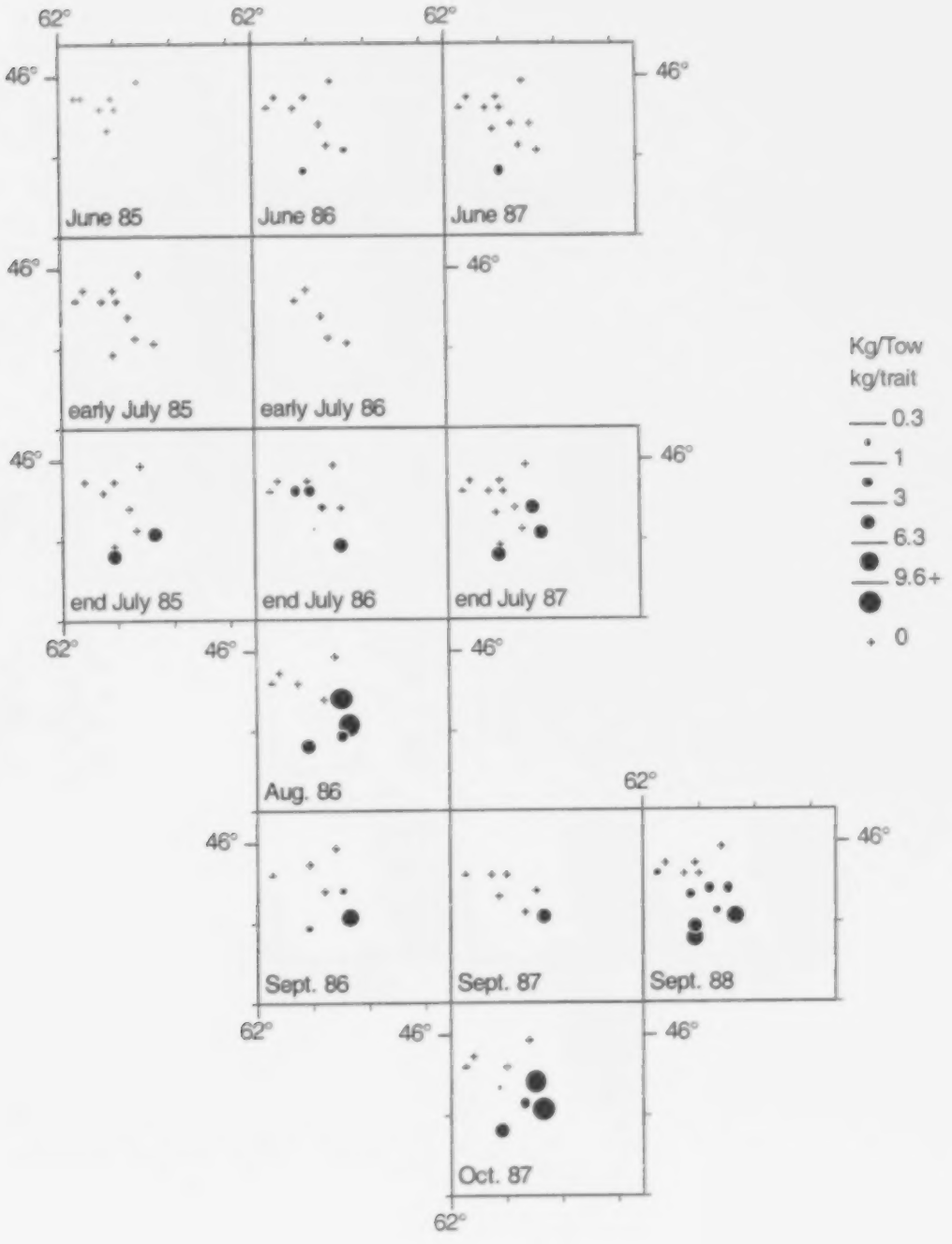

Figure 25. St. George's Bay seasonal distribution of catches (kg/tow) of Lobster, *Homarus americanus*.

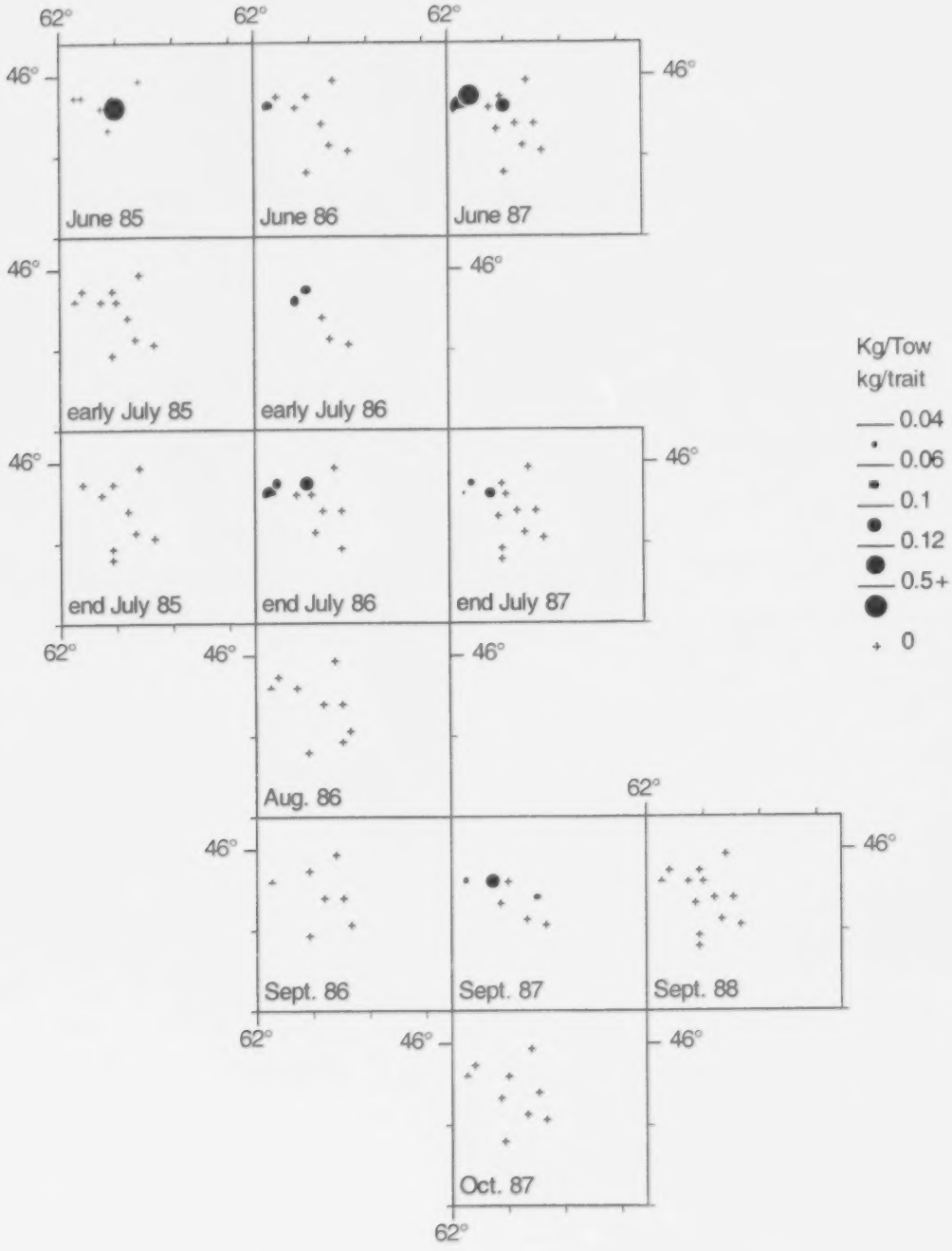

Figure 26. St. George's Bay seasonal distribution of catches (kg/tow) of Snails and Slugs, Gastropoda.

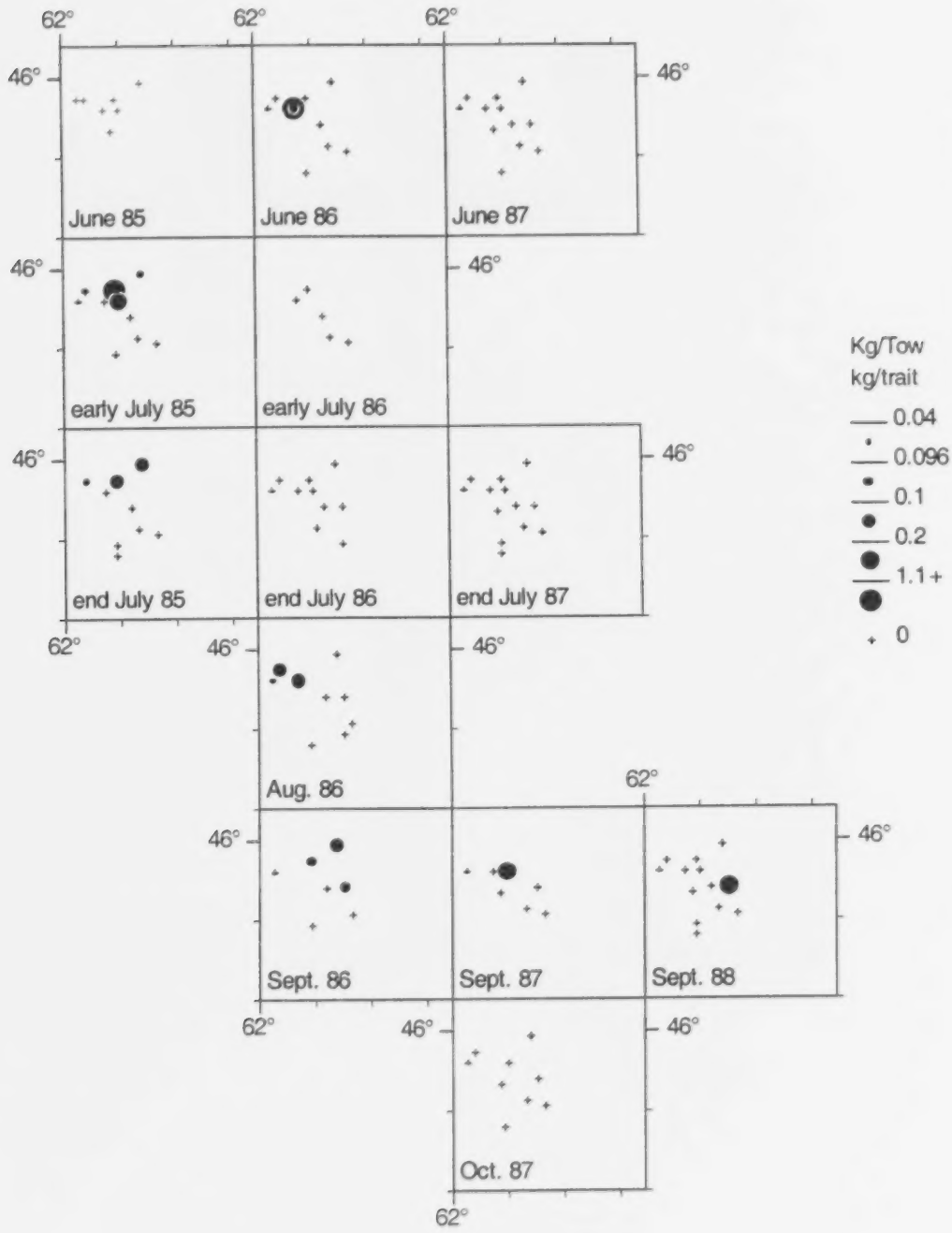

Figure 27. St. George's Bay seasonal distribution of catches (kg/tow) of Whelks, *Buccinum sp.*

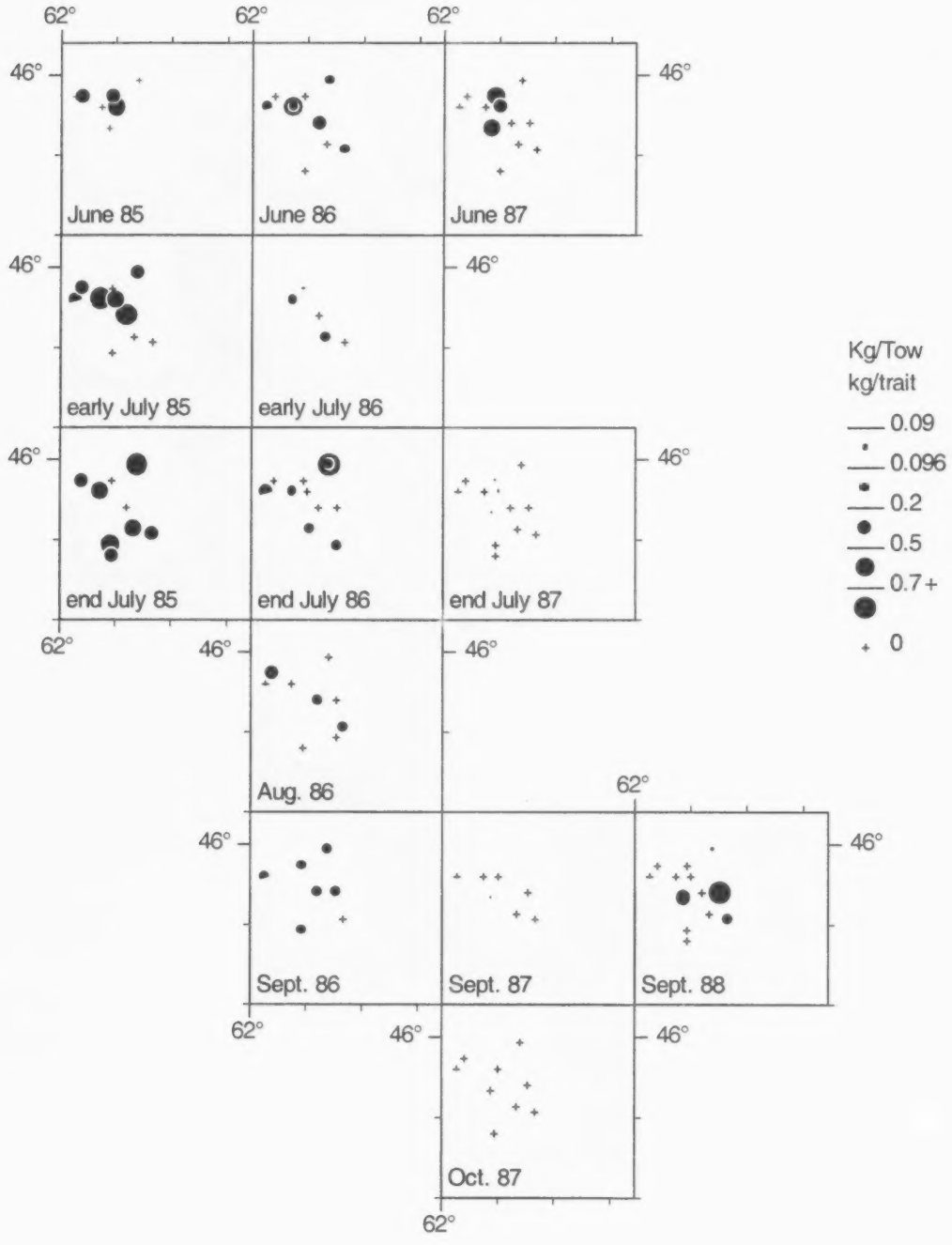

Figure 28. St. George's Bay seasonal distribution of catches (kg/tow) of Starfish, Asteroidea.

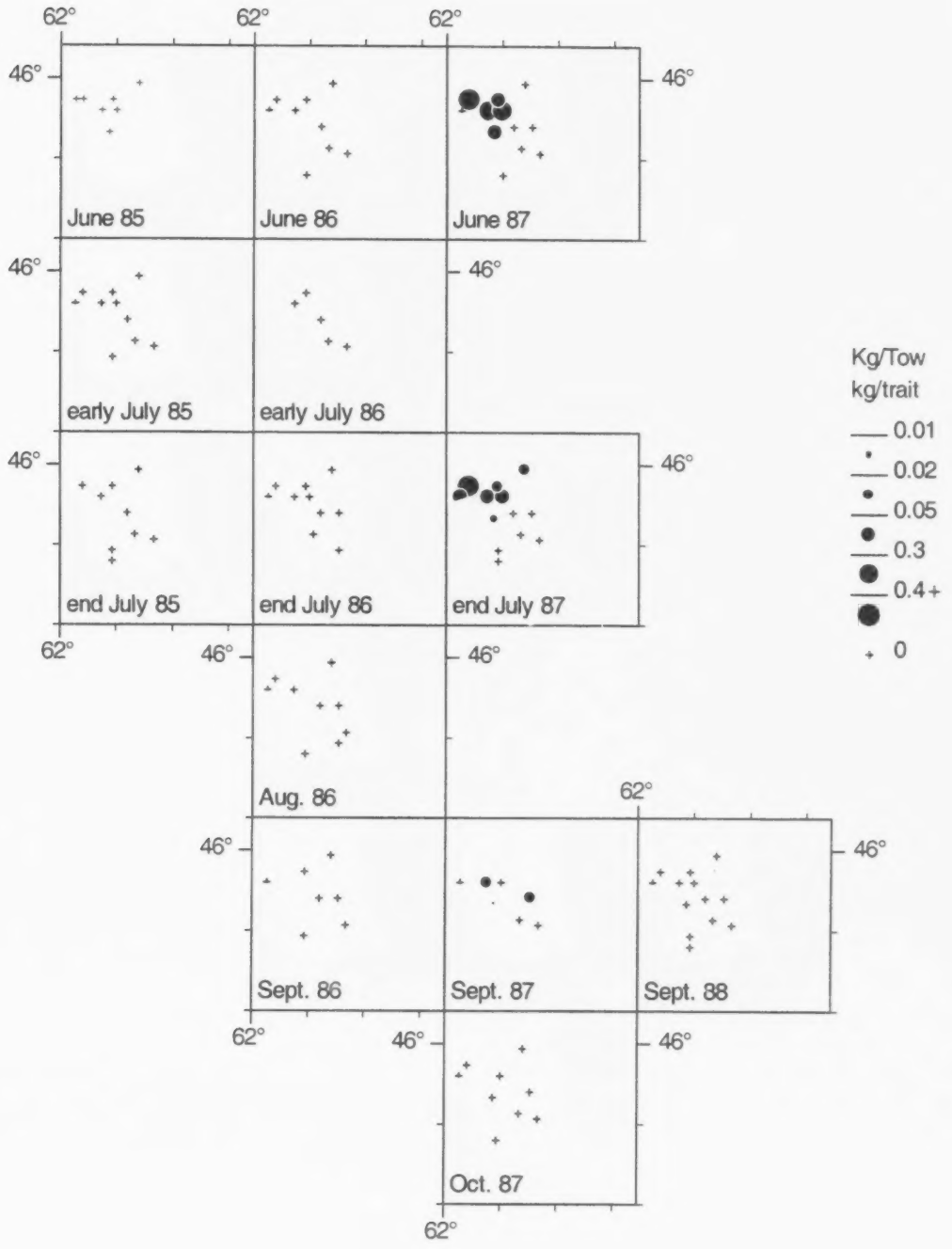

Figure 29. St. George's Bay seasonal distribution of catches (kg/tow) of Mud Star, *Ctenodiscus crispatus*.

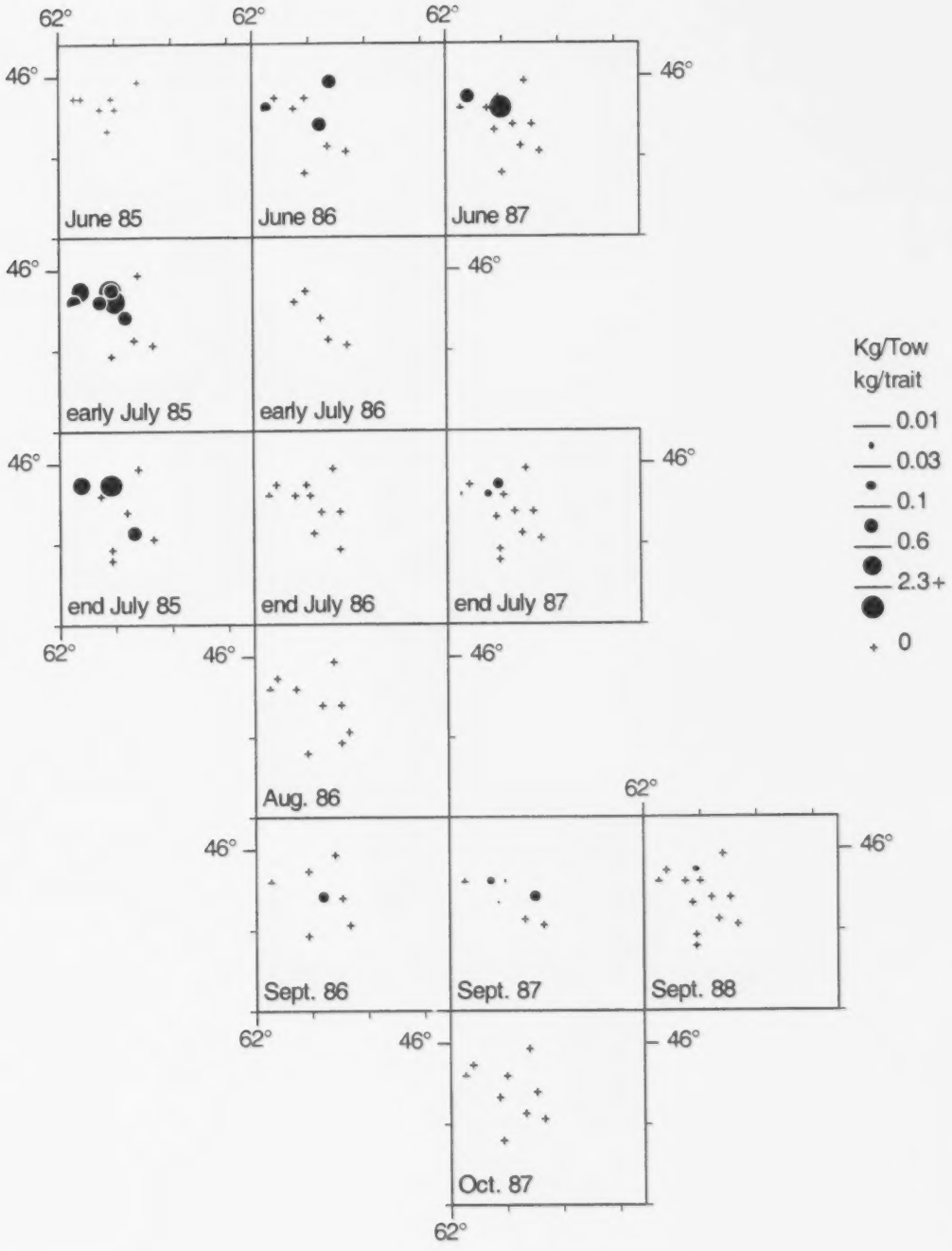

Figure 30. St. George's Bay seasonal distribution of catches (kg/tow) of Brittle Stars, Ophiuroidae.